1984 NATIONAL BUREAU OF STANDARDS AUTHORIZATION

HEARINGS

BEFORE THE

SUBCOMMITTEE ON
SCIENCE, RESEARCH AND TECHNOLOGY

OF THE

COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

NINETY-EIGHTH CONGRESS

FIRST SESSION

MARCH 22 AND 23, 1983

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1984 NATIONAL BUREAU OF STANDARDS AUTHORIZATION

TUESDAY, MARCH 22, 1983

House of Representatives,
Committee on Science and Technology,
Subcommittee on Science, Research and Technology,
Washington, D.C.

The subcommittee met, pursuant to notice, at 1:50 p.m., in room 2318, Rayburn House Office Building, Hon. George E. Brown, Jr., presiding. Present: Representatives Walgren, Brown, Mineta, Reid, Gregg, Boehlert, Sensenbrenner, McGrath, Skeen, and Bateman.

Mr. Brown. The subcommittee will come to order. The chairman would like to have me apologize for his delay, and I will take over the chair temporarily in his absence.

Without objection, an opening statement by the chairman will be inserted in the record at this point. I would read it except, because of the time we've lost, I think it would be easier to do it this way.

Do any of the members have anything else to say?

[Negative response.]

[The opening remarks of Mr. Walgren follow:]

OPENING REMARKS
BY
THE HONORABLE DOUG WALGREN, CHAIRMAN
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
MARCH 22, 1983
HEARING ON NATIONAL BUREAU OF STANDARDS AUTHORIZATION
FOR FISCAL YEAR 1984

TODAY WE BEGIN TWO DAYS OF HEARINGS ON THE PRESIDENT'S BUDGET PROPOSAL FOR THE NATIONAL BUREAU OF STANDARDS, AND FOR TWO SMALLER BUT IMPORTANT ORGANIZATIONS, THE OFFICE OF THE ASSISTANT SECRETARY FOR PRODUCTIVITY, TECHNOLOGY AND INNOVATION (OPTI) AND THE NATIONAL TECHNICAL INFORMATION SERVICE (NTIS).

OUR PRELIMINARY ANALYSIS OF THE BUDGET SHOWS SEVERAL TRENDS. WITH RESPECT TO THE SUPPORT OF BASIC RESEARCH, A MAJOR TURNAROUND HAS TAKEN PLACE IN THE ADMINISTRATION'S POLICY. THE FEELING THAT BASIC RESEARCH SHOULD ABSORB ITS SHARE OF THE CUTS BEING EXPERIENCED BY THE OTHER DOMESTIC PROGRAMS HAS BEEN ABANDONED IN FAVOR OF LARGE INCREASES FOR SELECTED BASIC RESEARCH PROGRAMS.

HOWEVER, THOSE INCREASES ARE ACCOMPANIED BY AN ABSENCE OF NEW INITIATIVES IN APPLIED RESEARCH AND TECHNOLOGY DEVELOPMENT, AND SUBSTANTIAL CUTBACKS IN THE EXISTING PROGRAMS IN THIS CATEGORY. SPECIFICALLY, SEVERAL MAJOR PROGRAMS AT THE NATIONAL BUREAU OF STANDARDS, WHICH HAVE HAD THE STRONG SUPPORT OF THIS SUBCOMMITTEE IN RECENT YEARS WOULD BE ELIMINATED ENTIRELY WHILE SOME OF THE INITIATIVES ENACTED INTO PUBLIC·LAW UNDER THE STEVENSON WYDLER LAW

ARE NOT MOVING FORWARD.

FOR THE CURRENT FISCAL YEAR, FY 1983, THE NBS RECEIVED AN APPROPRIATION OF $117.9 MILLION. THAT AMOUNT REPRESENTED A DECREASE OF $2.4 MILLION FROM FISCAL YEAR 1982, WHEN THE LEVEL WAS $120.3 MILLION. THE PROPOSED BUDGET LEVEL FOR THE NEXT FISCAL YEAR IS $98 MILLION. THIS WOULD REPRESENT A REDUCTION OF $19.2 MILLION.

FOR OPTI, THE BUDGET PROPOSES A MODEST INCREASE OF $308,000 WHICH WOULD BRING THE TOTAL TO $5.7 MILLION. HOWEVER, THIS SMALL CHANGE REFLECTS A CUT-BACK FROM $3 MILLION TO $2 MILLION IN "PRODUCTIVITY ENHANCEMENT" AND SMALLER INCREASES OF $900,000 FOR "COMPETITIVE ASSESSMENTS" AND $365,000 FOR "POLICY IMPLEMENTATION". AT A TIME WHEN OUR BALANCE OF TRADE CONTINUES TO BE NEGATIVE, AND THE NEED TO STRENGTHEN THE COMPETITIVENESS OF OUR INDUSTRY IS MORE URGENT THAN EVER, SHOULD WE NOT SUBSTANTIALLY INCREASE THE DEPARTMENT'S WORK IN THESE AREAS?

FOR THE NTIS NO DIRECT APPROPRIATION IS REQUESTED IN THE EXPECTATION THAT THE TOTAL OPERATING BUDGET OF $29 MILLION CAN BE RECOVERED ENTIRELY THROUGH THE SALE OF PUBLICATIONS. HOWEVER, NTIS IS ASKING FOR A $5 MILLION WORKING CAPITAL FUND TO ENHANCE THE STABILITY OF THEIR FINANCIAL OPERATIONS.

WE MUST EXAMINE ALL THESE PROPOSALS CAREFULLY, BOTH IN TERMS OF THE MERITS OF EACH OF THE INDIVIDUAL PROGRAMS AND IN TERMS OF THEIR BROADER IMPACT ON THE BUREAU AS A WHOLE AND ON THE NATION'S TOTAL R&D EFFORT.

PROPOSED FOR OUTRIGHT ELIMINATION ARE THE CENTER FOR FIRE RESEARCH AND THE CENTER FOR BUILDING TECHNOLOGY. THE FIRE RESEARCH CENTER WAS ESTABLISHED BY LEGISLATION WHICH ORIGINATED IN THIS SUBCOMMITTEE IN 1973. WE ARE NOT AWARE OF ANY VIEWS FROM THE FIRE COMMUNITY THAT THIS RESEARCH WORK CAN BE TURNED OVER TO THE PRIVATE SECTOR AS PROPOSED, AND WE ARE VERY MUCH AWARE OF THE VALUE OF THE RESEARCH FOR FIRE PREVENTION.

THE BUILDING RESEARCH CENTER PROVIDES MUCH NEEDED INFORMATION ON A WIDE RANGE OF MATERIALS THAT GO INTO TODAY'S MODERN, RESIDENTIAL, OFFICE, AND INDUSTRIAL BUILDINGS. IN ADDITION, THE NEED FOR AN INDEPENDENT, HIGH-QUALITY SOURCE OF ADVICE AND ANALYSIS ON BUILDING TECHNOLOGY QUESTIONS WAS DEMONSTRATED WHEN THE KANSAS CITY HOTEL COLLAPSE TOOK PLACE, KILLING SCORES OF PEOPLE, AND THE BUREAU OF STANDARDS WAS CALLED IN TO INVESTIGATE ITS CAUSES.

THE PROPOSAL FOR THE COMPUTER INSTITUTE WOULD ALMOST WIPE IT OUT. A REDUCTION FROM $10 MILLION TO $3 MILLION WOULD SEVERELY CURTAIL THE INSTITUTE'S WORK IN DEVELOPING INTERFACE STANDARDS FOR COMPUTERS, AN ACTIVITY THAT PLAYS A SIGNIFICANT ROLE IN MAINTAINING THE COMPETITIVENESS OF AMERICAN EQUIPMENT MANUFACTURERS BOTH DOMESTICALLY AND INTERNATIONALLY.

THE ROBOTICS PROGRAM HAS HAD THE SUPPORT OF THE CONGRESS AND OF THIS COMMITTEE AS AN EFFORT IN A SPECIFIC AREA WHERE ADVANCES ARE BEING MADE IN JAPAN AND EUROPE, AND WHERE THE NBS HAS A UNIQUE CONTRIBUTION TO MAKE. ALTHOUGH WE UNDERSTAND THAT SIGNIFICANT NEW

FUNDING MAY BE MADE AVAILABLE BY THE DEPARTMENT OF DEFENSE, WE WILL WANT TO DETERMINE HOW A STRONGER PROGRAM CAN DEVELOP THE TECHNOLOGY IN THIS AREA AT A MUCH FASTER RATE.

THE IMPACT OF THE PROPOSED REDUCTIONS ON THE BUREAU AS A WHOLE IS OF EQUAL CONCERN. THE IMMEDIATE EFFECT WOULD BE THE NEED TO INSTITUTE YET ANOTHER REDUCTION-IN-FORCE, THIS TIME INVOLVING AN ESTIMATED 300-400 POSITIONS. BECAUSE OF THE RIPPLE EFFECT OF SUCH RIF'S THROUGHOUT THE BUREAU'S PROFESSIONAL STAFF, REDUCTIONS IN STAFF ARE HIGHLY DISRUPTIVE AND HAVE NEGATIVE EFFECTS ON CONTINUITY AND MORALE BEYOND THE FISCAL YEAR IN WHICH THEY OCCUR. WE MUST SEEK TO MINIMIZE THE NEED FOR SUCH DISRUPTIONS.

ANOTHER CONCERN IS THAT FOR ALMOST FIVE YEARS THE NBS HAS SOUGHT TO ACQUIRE A MODERN COMPUTER FOR USE BY THE SCIENTIFIC STAFF. FUNDS FOR THIS PURPOSE WERE AUTHORIZED AND APPROPRIATED BY THE CONGRESS IN FISCAL YEAR 1982. YET SUCCESSIVE DELAYS HAVE BEEN EXPERIENCED BECAUSE OF A LONG SERIES OF STUDIES. I BELIEVE THAT THE TIME HAS COME TO PURCHASE A COMPUTER WITHOUT FURTHER STUDIES OR DELAYS. IN MY VIEW, THE BUREAU SHOULD BE AT THE CUTTING EDGE BOTH IN ITS SCIENTIFIC RESEARCH, AND IN ITS INSTRUMENTATION, FACILITIES AND COMPUTER CAPABILITIES.

FINALLY, I WANT TO NOTE THAT THIS YEAR THE BUDGET PRESENTATION FOR THE FIRST TIME REFLECTS A NUMBER OF CHANGES AIMED AT IMPROVING ITS USEFULNESS TO THE COMMITTEE. I WANT TO EXPRESS OUR APPRECIATION TO DIRECTOR AMBLER AND HIS STAFF FOR WORKING WITH OUR SUBCOMMITTEE TO BRING ABOUT THIS IMPROVEMENT IN THE BUDGET BOOK FORMAT.

Mr. **Brown**. This afternoon, we are meeting to discuss certain aspects of the Department of Commerce and the Bureau of Standards and we are pleased to have Dr. Bruce Merrifield, the Assistant Secretary of Commerce for Productivity, Technology and Innovation as our first witness, accompanied by Mr. Egils Milbergs, Director of that office, and Dr. Joseph Caponio, Director of NTIS. You gentlemen are going to tell us what's happening over there and how good it is.

Dr. Merrifield, you may proceed.

Dr. **Merrifield**. With the Chairman's permission, I'd like to summarize my written testimony, which I would request to appear in full in the record.

Mr. **Brown**. It will appear in full in the record, Dr. Merrifield, following your statement and without objection.

[The biographical sketch of Dr. Merrifield follows:]

Dr. D. Bruce Merrifield

Dr. Merrifield did his undergraduate work at Princeton University and his doctoral work at the University of Chicago in Physical Organic Chemistry.

He has since been in research and research administration, and is presently Vice President of Technology and Venture Management for the Continental Group, Inc., New York City.

He is a Director of the Industrial Research Institute; Chairman of the Board of the IRI Research Corporation and has been a Trustee and Chairman of the Research Council for the American Management Association.

He is a Fellow of the American Association for Advancement of Science; a Fellow of the American Institute of Chemists; a member of Sigma Xi Honorary Society; a member of the Directors of Industrial Research, as well as a number of other organizations.

Dr. Merrifield has been active in community affairs, serving as Chairman of the Board of Education; as National Chairman of the Princeton Alumni Association; as a Trustee of several schools and several foundations. He is a member of the Executive Council of the Episcopal Church and a Vestryman of Trinity Church, New York.

Dr. Merrifield assumes his present position as Assistant Secretary of Commerce for Productivity, Technology and Innovation in May 1982.

STATEMENT OF DR. D. BRUCE MERRIFIELD, ASSISTANT SECRETARY FOR PRODUCTIVITY, TECHNOLOGY AND INNOVATION, U.S. DEPARTMENT OF COMMERCE, ACCCOMPANIED BY DR. JOSEPH F. CAPONIO, DIRECTOR, NATIONAL TECHNICAL INFORMATION SERVICE AND DR. EGILS MILBERGS, DIRECTOR, OFFICE OF PRODUCTIVITY, TECHNOLOGY AND INNOVATION

Dr. **Merrifield**. I am pleased to be here to discuss the functions, organization and activities of the Office of the Assistant Secretary of Commerce for Productivity, Technology and Innovation and to support the enactment of H.R. 1996, the National Bureau of Standards Authorization Act for fiscal years 1984 and 1985 and the Technical Information Clearinghouse Fund Act of 1983.

My testimony on the NBS Authorization Act is limited to section 4, which would authorize appropriations for the Office of Productivity, Technology and Innovation.

Dr. Ambler, the Director of NBS, will testify in support of the rest of that bill which pertains to NBS.

Regarding the Technical Information Clearinghouse Fund Act, the subcommittee staff has received copies but, to the best of my knowledge, the bill has not been introduced in the House yet. I hope you will introduce it, Mr. Chairman, as soon as possible.

As Assistant Secretary for Productivity, Technology and Innovation, I serve as the principal advisor to the Secretary of Commerce and other Government policy officials on issues of productivity, technological innovation, future competitiveness of industrial sectors, and strategic resources.

The four major elements reporting to me are OPTI, the National Technical Information Service, the Office of Competitive Assessment and the Office of Strategic Resources. My testimony focuses upon the first of these elements—OPTI—because, unlike the others, it requires a reauthorization of appropriations. NTIS does not require periodic reauthorizations or annual appropriations because it operates on a self-sustaining basis.

Annual appropriations for the OCA are already authorized by the continuing authority provided the Secretary of Commerce to perform economic studies, and annual appropriations for OSR are already authorized by the continuing authority of the National Materials Policy, Research and Development Act of 1980.

Briefly stated, OPTI: (1) identifies regulatory, economic and human resource barriers to productivity growth and recommends policy remedies; (2) disseminates information on innovative R&D mechanisms; (3) accelerates the transfer of Federally-developed and funded technology to the private sector; (4) provides the private sector with information on productivity improvement; and (5) serves as the central Federal source of metric information and coordinates the voluntary metric conversion activities of other Federal agencies, State and local governments, and the private sector.

The total authorization requested for OPTI is $3,752,000 for fiscal year 1984 and such funds as may be necessary for fiscal year 1985.

It's up to the private sector to carry out the technological developments and productivity enhancements needed to improve its competitiveness in world markets. The mission of OPTI is to examine and seek to modify, where appropriate, Government policies and programs that influence the climate within which the private sector must accomplish these tasks. For example, OPTI is evaluating the cost effectiveness of the incremental tax credit and the effects that our antitrust laws now have on the formation and conduct of joint ventures.

This year, OPTI initiated an industrial technology partnership—an ITP program—designed to stimulate higher levels of private R&D investment in the United States. A main focus of this program is to facilitate the greater use by the private sector of R&D limited partnerships. These partnerships are designed to foster large-scale R&D efforts that are beyond the risk threshhold of individual companies. The use of R&D limited partnerships minimizes antitrust and other legal problems, and also builds on existing tax incentives that reduce the risks associated with attempting to develop new advanced technologies.

I expect that total non-Government funding of new technology will significantly increase as greater use is made of the R&D limited partnership mechanism.

As part of the ITP Program, OPTI is supporting the Center for the Utilization of Federal Technologies, CUFT, established by the

Stevenson-Wydler Technology Innovation Act of 1980. CUFT, which is located at, and is directly managed by, NTIS, monitors the technology transfer activities of Federal labs and disseminates technical information generated by them. We expect that CUFT will become self-supporting within the next 2 years.

Of the total requested OPTI authorization of $3,752,000 for fiscal year 1984, $1 million is for the ITP Program including CUFT. This represents a fiscal year 1984 reduction of $1 million from the $2 million appropriated for 1983. In 1983, $1 million is allocated for start-up costs and for generation and analysis of industry data in selected technical areas. This expenditure will not be necessary in 1984.

One million thirty thousand dollars of the requested OPTI authorization is for productivity improvement and related activities. To assist individual firms in assessing their progress toward improved productivity, one OPTI goal is the development of quantitative methods of measuring total factor productivity.

Through information and outreach programs and its Productivity Resource Center, OPTI provides businesses with current detailed information on productivity improvement including company productivity programs and how to implement them, new management techniques, how to maintain better labor relations, and new R&D strategies.

In the area of White House initiatives, the President has announced that he will establish a Commission on Industrial Competitiveness and that a White House Conference on Productivity will be conducted later this year.

Another activity area of OPTI for which $484,000 of the requested authorization is allocated, is Government patent policy. OPTI is expediting Government-wide implementation of Public Law 96-517, which extends ownership of patent rights to small and non-profit businesses.

On February 18, 1983, President Reagan issued a memorandum on Government Patent Policy which directs all Federal agencies to extend ownership of patent rights to all businesses, whether small or large; profit or non-profit to the fullest extent permitted by law. This directive takes a major step toward increasing the incentive for private sector commercialization of Government-funded inventions. We are increasing our efforts to license, through NTIS, private-sector use of patents owned by the U.S. Government.

There is a large backlog of unexploited inventions available for license. Eight hundred and seventy-six thousand dollars of our requested 1984 authorization is for this licensing activity, an increase of $376,000 over the $500,000 requested for '83. This increase is needed to permit us to issue a greater number of licenses and associated unpatented technological information and counterpart foreign patents.

Even though metric measures are becoming more common in the United States, we still essentially retain our inch-pound system while all but four other countries in the world use the metric system—Burma, North and South Yemen and Brunei.

OPTI is working to remove barriers that may stand in the way of voluntary metric conversion. For example, we are examining procedures for including metric units in all Federal Procurement Standards. Coordination with other Federal agencies is provided through the Interagency Committee on Metric Policy and through direct consultation.

OPTI also, supplies information about the metric system to business and the public, and assists, when requested, in the conversion process. Three hundred sixty-two thousand dollars of our requested authorization is allocated to continue these activities in 1984.

Now, a few words about the National Technical Information Service [NTIS]: (1) serves as a clearinghouse for the public sale, on a self-supporting basis, of federally sponsored R&D, for engineering and technical reports and analyses prepared by Federal, State and local government agencies, and foreign technological literature; (2) it operates CUFT, which alerts industry to Federal technology having potential commercial or practical application; (3) conducts a patent-licensing program to increase private sector use of patented Government inventions by evaluating, promoting and licensing commercially the more promising of those inventions, and by applying for foreign patents on them. NTIS also supports the ITP program by providing technical data-base searches and other services.

Earlier, I mentioned the Technical Information Clearinghouse Fund Act of 1983 recently sent to Congress by the Secretary. This act would establish revolving fund authority for NTIS. Because NTIS lacks revolving fund authority, it must use a trust account established for it in the Treasury. Legal technicalities associated with trust accounts prevent us from fulfilling the statutory directive of 15 U.S.C. 1153 that NTIS be operated on a self-sustaining basis.

Trust fund earnings cannot be used to replace major capital assets, thus necessitating occasional appropriations.

Further, earnings cannot be retained to cover low-cash periods, which NTIS periodically experiences. To remain solvent during low-cash periods, NTIS has shown a great degree of innovation by using advance customer deposits as a source of working capital. This practice is, however, highly undesirable, since customer monies are held in trust to pay for future goods and services.

These problems could be easily solved without cost to the general taypayer if the Technical Information Clearinghouse Fund Act is enacted. All would benefit, especially the users of NTIS products and services. A revolving fund will allow NTIS to modernize financial practices and generally improve management control of operations. Moreover, new-user services could be added in response to user demand without having to seek and obtain appropriated funds. Let me allay any fears you may have. Oversight jurisdiction by this subcommittee would continue and, of course, NTIS would remain responsive to the subcommittee's directives.

Dr. Caponio has, for some time now, been the Acting Director of NTIS. It gives me great pleasure to announce that Dr. Caponio has just been named Director. He is here with me today to answer any questions you may have regarding NTIS and the Technical Information Clearinghouse Fund Act of 1983. Dr. Caponio has submitted a detailed statement for the record in support of the enactment of that legislation.

My written statement discusses the objectives and activities of the two other major elements reporting to me—the Office of Competitive Assessment [OCA], and the Office of Strategic Resources [OSR]. I will refer you to that rather than taking time away from your questions, which Dr. Caponio, Egils Milbergs, the Director of OPTI, and I will be happy to answer.

This completes my prepared remarks.

[The prepared statement of Dr. Merrifield follows:]

STATEMENT OF
DR. D. BRUCE MERRIFIELD
ASSISTANT SECRETARY OF COMMERCE
FOR PRODUCTIVITY, TECHNOLOGY AND INNOVATION

Mr. Chairman and Members of the Subcommittee, I am pleased to be here to discuss the organization, functions and activities of the Office of the Assistant Secretary for Productivity, Technology and Innovation, and to support enactment of two bills recently sent to Congress for its consideration by Secretary of Commerce Malcolm Baldrige. These bills are H.R. 1996, the National Bureau of Standards (NBS) Authorization Act for Fiscal Years 1984 and 1985, and the Technical Information Clearinghouse Fund Act of 1983. With regard to H.R. 1996, my testimony is limited to section 4, which would authorize appropriations for the Office of Productivity, Technology and Innovation (OPTI) -- one of four major elements of the Office of the Assistant Secretary for Productivity, Technology and Innovation. Dr. Ambler, the Director of NBS, will testify in support of the rest of that bill, which pertains to NBS.

In my capacity as Assistant Secretary for Productivity, Technology and Innovation in the Office of the Under Secretary for Economic Affairs, I serve as the principal advisor to the Secretary of Commerce and other high Government policy officials on issues of productivity, technological innovation, future competitiveness of industrial sectors, and strategic resources. The four major elements reporting to me are OPTI, the National Technical Information Service (NTIS), the Office of Competitive Assessment (OCA), and the Office of Strategic Resources (OSR).

My testimony focuses upon the first of these elements -- OPTI -- because unlike the others, it requires a reauthorization of appropriations. NTIS does not require periodic reauthorizations or annual appropriations because it operates on a self-sustaining basis. Annual appropriations for OCA are already authorized by the continuing authority provided the Secretary of Commerce to perform economic studies, and annual appropriations for OSR are already authorized by the continuing authority of the National Materials Policy, Research and Development Act of 1980.

Briefly stated, OPTI: 1) identifies regulatory, economic and human resource barriers to productivity growth and recommends policy remedies to top administration officials to make our economic climate more conducive to productivity growth:
2) disseminates information on innovative R&D mechanisms that would enable firms that cannot conduct sufficient research on their own to benefit from larger scale research programs;
3) accelerates the transfer of Federally-developed and -funded technology to the private sector by supporting NTIS's Center for the Utilization of Federal Technology (CUFT), by aggressively licensing, through NTIS, Government-owned patents, and by expediting Government-wide implementation of recent changes to our patent policy laws and promoting additional changes to those laws to permit all R&D contractors and

grantees, regardless of size, to retain ownership of Government-funded inventions; 4) provides the private sector with information on productivity improvement; and 5) serves as the central Federal source of metric information and coordinates the voluntary metric conversion activities of other Federal agencies, State and local governments, and the private sector.

The total authorization requested for OPTI is $3,752,000 for FY 1984 and such funds as may be necessary for FY 1985.

A primary goal of OPTI is to stimulate increased productivity and new product development by the private sector without direct Government intervention. The authorization requested for OPTI reflects that goal. It is up to the private sector to carry out the technological developments and productivity enhancements needed to improve its competitiveness in world markets. The mission of OPTI is to examine and seek to modify, where appropriate, Government policies and programs that influence the climate within which the private sector must accomplish these tasks. For example, OPTI is evaluating the cost effectiveness of the investment tax credit and the effects that our antitrust laws have on the formation and conduct of joint ventures. Where barriers impede private sector initiatives, OPTI works to remove them, and devise and recommend policies and methods to provide incentives for private sector action.

This year, OPTI initiated an Industrial Technology Partnership (ITP) Program designed to stimulate higher levels of private R&D investment in the U.S. A main focus of this program is to facilitate greater private sector use of R&D limited partnerships. While not joint or cooperative research ventures, these partnerships are designed to foster large-scale R&D efforts that are beyond the risk threshold of individual companies. The use of R&D limited partnerships minimizes antitrust and other legal problems, and also builds on existing tax incentives that reduce the risks associated with developing new advanced technologies.

OPTI has developed a draft set of guidelines that explains the details of these partnerships including how to form them and their tax ramifications. Properly structured and aided by incentives provided by the Economic Recovery Tax Act, the Tax Equity and Fiscal Responsibility Act, and other tax incentives, R&D limited partnerships, can fund and perform R&D needed by our corporations. Investors -- the limited partners -- fund the R&D. Users of the R&D -- the corporations -- avoid having to fund needed R&D from retained earnings, from borrowing, or from new equity. I expect that total non-Government funding of new technology will significantly increase as greater use is made of the R&D limited partnership mechanism.

Another important part of the ITP Program is to stimulate the formation of joint and cooperative R&D activities. OPTI is collecting and disseminating information to the private sector on foreign cooperative R&D efforts, as well as on productivity improvement efforts, procedures, and experiences of foreign and domestic companies. OPTI is also participating in the analysis of barriers to joint and cooperative R&D for the Cabinet Council on Legal Policy through a special working group on antitrust issues. In addition, OPTI, in collaboration with the Department of the Treasury, is analyzing, for possible revision, existing tax laws, particularly with respect to R&D, that may impede private sector investment or create uncertainty in the fast changing world of technology-driven industries.

As part of the ITP Program, OPTI is supporting the Center for the Utilization of Federal Technology (CUFT), established by the Stevenson-Wydler Technology Innovation Act of 1980. CUFT, which is located at, and is directly managed by, NTIS, monitors the technology transfer activities of Federal laboratories and disseminates technical information generated by them. We expect that CUFT will be self-supporting within the next two years.

Of the total requested OPTI authorization of $3,752,000 for FY 1984, $1,000,000 is for the ITP Program. This represents a FY 1984 reduction of $1,000,000 from the $2,000,000 appropriated for FY 1983. In FY 1983, $1,000,000 is allocated for start-up costs and for generation and analysis of industry data in selected technical areas. This expenditure will not be necessary in FY 1984. Other ITP Program activities will not be reduced.

$1,030,000 of the requested OPTI authorization is for productivity improvement and related activities. Labor costs are only one factor among many in the productivity performance of individual firms. Other factors also contribute to what is termed "total factor productivity." To assist individual firms in assessing their progress toward improved productivity, one OPTI goal is the development of quantitative methods of measuring "total factor productivity." Through information and outreach programs and its Productivity Resource Center, OPTI provides businesses with current detailed information on productivity improvement including company productivity programs and how to implement them, new management techniques, how to maintain better labor relations, and new R&D strategies. In addition, OPTI conducts private sector productivity improvement seminars and workshops.

OPTI is identifying barriers to productivity and recommending remedies for consideration by Cabinet Councils and advisory bodies such as the National Productivity Advisory Committee. In the area of White House initiatives, the President has announced that he will establish a Commission on Industrial Competitiveness and that, in accordance with the White House Conference on Productivity Act recently signed into law, a White House Conference on Productivity will be conducted later this year.

Another activity area of OPTI, for which $484,000 of the requested authorization is allocated, is Government patent policy, especially as such policy affects the ability of our industries to be more competitive in world markets. Approximately one-half of total U.S. R&D spending is funded by the Federal Government. The results from Government-funded R&D follow an uncertain path to the private sector, in part because of difficulty in identifying which R&D results offer commercial potential, and, in part, because of statutory limitations on the ownership by the private sector of proprietary rights. Through its Office of Government Patent Policy, OPTI is developing procedures to improve the identification and dissemination of the results of Federally-funded R&D that could benefit the private sector. OPTI is also expediting Government-wide implementation of Public Law No. 96-517, which grants ownership of patent rights to small and non-profit businesses. On February 18, 1983, President Reagan issued a Memorandum on Government Patent Policy which directs all Federal agencies to extend the ownership of patent rights to all businesses, whether small or large, profit or non-profit, to the fullest extent permitted by law. This directive takes a major step toward increasing the incentive for private sector commercialization of Government-funded inventions. Where existing statutes do not permit private sector ownership of patent rights for all businesses, the Administration is supporting legislation which would permit such ownership.

We are increasing our efforts to license, through NTIS, private sector use of patents owned by the U.S. Government. There is a large backlog of unexploited inventions available for license. $876,000 of our requested FY 1984 authorization is for this licensing activity, an increase of $376,000 over the $500,000 requested for FY 1983. This increase is needed to permit us to issue a greater number of licenses. Further, we expect to enlarge the portfolio being promoted for license by adding associated unpatented technological information and counterpart foreign patents. Appropriations are necessary to support our patent licensing program because revenue derived from licenses granted must be remitted to the Treasury.

One barrier to effective use of U.S. developed technology is the lack of uniformity of our system of measurement with the system prevalent in the rest of the world. Even though metric measures are becoming more common in the U.S., we still essentially retain our inch-pound system while all but four other countries in the world use the metric system. OPTI, through its Office of Metric Programs, is working to remove barriers that may stand in the way of voluntary metric conversion. For example, we are examining procedures for including metric units in all Federal Procurement Standards. Coordination with other Federal agencies is provided through the Interagency Committee on Metric Policy and through direct consultations. Also, OPTI supplies information about the metric system to business and the public, and assists, when requested, in the conversion process. $362,000 of our requested authorization is allocated to continue those activities in FY 1984.

Now, a few words about the non-OPTI elements reporting to me.

First, the National Technical Information Service. NTIS: 1) serves as a clearinghouse for the public sale, on a self-supporting basis, of Federally-sponsored R&D, engineering and technical reports and analyses prepared by Federal, State and local government agencies, and foreign technological literature; 2) operates CUFT, which alerts industry to Federal technology having potential commercial or practical application; and 3) conducts a patent licensing program to increase private sector use of patented Government inventions by evaluating, promoting and licensing commercially the more promising of those inventions, and by applying for foreign patents on them.

The primary objectives of NTIS are: 1) to stimulate innovation and productivity throughout the U.S. economy and to improve the competitive position of U.S. industry in the world marketplace by making Federal technology, scientific, economic and engineering information readily accessible to business, industry, government, and others; 2) to develop new and improved information products for use by engineers and technicians; 3) to serve as the centralized source of information on Federally-supported ongoing research; 4) to increase the availability of foreign technical information within the U.S.; and 5) to convert from a labor intensive organization to a technology intensive organization through the application of advanced information processing and dissemination technology.

Let me give a few examples of how NTIS relates to the other units reporting to me. OPTI has primary responsibility for Government-wide patent policy and implementation of the Stevenson-Wydler Technology Innovation Act. NTIS has the operational responsibility for Government-owned patent licensing on behalf of eight Federal agencies, for CUFT, and for preparation of reports on the status of Federal technology and Federal technology transfer. NTIS also supports the ITP Program by providing technical data base searches and other services.

Earlier, I mentioned the Technical Information Clearinghouse Fund Act of 1983 recently sent to Congress by the Secretary. This Act would establish revolving fund authority for NTIS. Under 15 U.S.C. 1153, the users of NTIS's products and services are required to pay their costs. Because NTIS lacks revolving fund authority, it must use a trust account established for it in the Treasury. Legal technicalities associated with trust accounts prevent us from fulfilling the statutory directive that NTIS be operated on a self-sustaining basis. Trust fund earnings cannot be used to replace major capital assets, thus necessitating occasional appropriations. Further, earnings cannot be retained to cover low cash periods, which NTIS periodically experiences. Despite low cash periods, day-to-day operating expenses must nevertheless be somehow paid. To remain solvent during low cash periods, NTIS has shown great innovation by using advance customer deposits as a source of working capital. This practice is highly undesirable, since customer monies are held in trust to pay for future goods and services.

These problems could be easily solved without cost to the general taxpayer if the Technical Information Clearinghouse Fund Act is enacted. All would benefit, especially the users of NTIS's products and services. A revolving fund will allow NTIS to modernize financial practices through use of a cost accounting system similar to the system used by private companies, to match costs with revenues, to allow for a more accurate representation of NTIS's overall financial status, and generally improve management control of operations. Moreover, new user services could be added in response to user demand without having to seek and obtain appropriated funds. In short, NTIS would operate as a business succeeding or failing based on its ability to provide its users services not provided by the private sector because of a lack of sufficient profit incentive. Let me allay any fears you may have. Oversight jurisdiction by this Subcommittee would continue and, of course, NTIS would remain responsive to the Subcommittee's directives.

Before I leave this subject, I think it significant to note that OMB, GAO, Treasury, NTIS and the Department all agree that a trust fund is inadequate for NTIS's needs. The very fact that all five of these diverse entities agree on something probably means both that there really is a problem that needs fixing and that a good solution to it exists.

Dr. Caponio for some time now has been the Acting Director of the NTIS. It gives me great pleasure to announce that Dr. Caponio has just been named Director. He is here with me today to answer any questions you may have regarding NTIS and the Technical Information Clearinghouse Fund Act of 1983. Dr. Caponio has submitted a detailed statement for the record in support of the enactment of that legislation.

Next, our Office of Competitive Assessment. OCA: 1) conducts medium to long-range assessments of the international competitiveness of specific sectors of U.S. industry, including the identification of implications for the U.S. economy and of policy options for dealing with competitive prospects; 2) meets with representatives of the private sector to identify factors that influence private sector international competitiveness; and 3) identifies barriers impeding U.S. industy's ability to respond positively to long-term competitive problems and opportunities.

The principal objective of the Office is to increase the knowledge and awareness of high Governmental policy officials regarding the medium to long-range potential international competitiveness of specific sectors of U.S. industry, and to appraise them of the policy implications and policy options to deal with such potential outcomes through the performance of competitive assessments of various industrial sectors. Other objectives include: 1) enabling Government economic policymakers to incorporate a better understanding of future sector-specific impacts of macro government policies into the policy-making process; 2) improving Government economic policy and programs so as to facilitate the response of private industry to long term competitive problems and opportunities; and 3) communicating the results of competitive assessments to private industry in order to stimulate discussion and debate within sectors about the long-term strategic forces influencing the future international competitiveness of their businesses.

A competitive assessment is an evaluation of the competitive prospects of a specific sector of U.S. industry in the medium to long-range future based on quantitative analysis and an understanding of the forces driving the future of the industry in question. It consists of two parts: 1) sectoral analysis and forecast; and 2) policy implications.

By international competitiveness, I mean the collective judgments made by the purchasers of products or services when they choose the products or services originating in one country over those originating in another -- for reasons and underlying causes which are identified, weighted, and forecasted in the competitive assessment process.

Over FYs 83 and 84, OCA will conduct assessments of several sectors. Sectors being considered for selection include: petrochemicals, civil aircraft, digital switching, machine tools/robotics, office automation equipment, engineering materials, information services, international construction, telecommunication transmission systems, food products, pharmaceuticals, computers, energy storage and transmission equipment, banking and financial services, optical equipment and lenses, and industrial machinery components such as valves and bearings.

Let me give one example of now these assessments relate to the other activities of my Office. With respect to the ITP Program, the results of competitive assessments will indicate, first of all, whether industrial technology partnerships are a promising way of assuring the long range future competitiveness of an industrial sector. Second, if an industrial technology partnership is to be formed, the competitive assessment will be a major part of the data base from which the strategic focuses of the partnership can be developed.

Finally, our Office of Strategic Resources. OSR: 1) provides direction and coordination for nonfuel resource activities within the Department, cooperates with other agencies to carry out the President's National Materials and Minerals Program Plan and Report to Congress of April 5, 1982, and represents the Department on nonfuel resource issues before high level groups that coordinate our National Materials Policy, such as the Cabinet Council on Natural Resources and Environment; and 2) conducts materials needs studies as required by the National Materials and Minerals Policy, Research and Development Act of 1980.

The objectives of OSR are to: 1) improve coordination of non-fuel resource policy and implementation, within the Department of Commerce and among tne various agencies having non-fuel resource responsibilities (DOD, DOI, State, Treasury, FEMA, and GSA), and facilitate the involvement of all sectors of the materials producing, processing and using industries; 2) improve the non-fuel resource information base for government and industry; 3) reduce regulatory and administrative barriers adversely affecting sectors of the materials producing, processing and using industries; and 4) improve coordination and implementation of the non-fuel resource aspects of national security preparedness, within the Department of Commerce and among the various agencies having non-fuel resource responsiblities, and facilitate the involvement of all sectors of the materials producing, processing and using industries.

This completes my prepared remarks. Dr. Caponio, Egils Milbergs, the Director of OPTI, and I would be happy to answer any questions you may have.

Mr. **Brown**. Thank you, Dr. Merrifield.

Now, did Dr. Caponio wish to make his statement at this time?

Dr. **Caponio**. Mr. Chairman, I have, with your permission, submitted a statement for the record, for the establishment of the Technical Information Clearinghouse Fund Act, and I don't believe any further statement is warranted.

Mr. **Brown**. Without objection, that statement will be included in the record.

[The prepared statement of Dr. Caponio follows:]

U.S. DEPARTMENT OF COMMERCE
STATEMENT OF JOSEPH F. CAPONIO
ACTING DIRECTOR, NATIONAL TECHNICAL INFORMATION SERVICE
BEFORE THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
THE TECHNICAL INFORMATION CLEARINGHOUSE FUND ACT OF 1983

MARCH 22, 1983

Mr. Chairman and Members of the Subcommittee.

Thank you for the opportunity to submit a statement for the record in support of the enactment of legislation to establish a revolving fund for the National Technical Information Service.

The Act of September 9, 1950 (15 U.S.C. 1151-1157) - NTIS' enabling legislation - directs the Secretary of Commerce to establish and maintain within the Department of Commerce a clearinghouse for the collection and dissemination of scientific, technical and engineering information. Section 3 of the Act requires that the users of NTIS products and services, and not the general taxpayer, pay the costs of the clearinghouse. In September 1970, NTIS was established as a primary operating unit of the Department to serve as that clearinghouse. NTIS makes Federal technological, scientific, economic and engineering information accessible to business, industry, Government, and other interested individuals and organizations. Use of the technological information that NTIS disseminates serves to: improve the economic health and growth of U.S. business and industry, increase productivity and innovation in the U.S., improve the competitive position of U.S. firms in the world marketplace, and promote the utilization of foreign research and development to the U.S. industrial sectors.

In the conduct of its program, NTIS serves as the primary source for the public sale of Government-sponsored research and engineering reports, research in progress reports, machine-processed data files, and computer programs. As this central source, NTIS provides and promotes a full array of products and services designed to permit wider utilization of technology.

On February 16, 1983, the Secretary of Commerce transmitted to Congress Administration-approved draft legislation to establish a revolving fund to be used by the Secretary of Commerce to carry out all activities of NTIS. This revolving fund will utilize a cost accounting system similar to the system used by private companies. All NTIS expenses would be paid from the fund, and the fund would be reimbursed from sales receipts.

NTIS presently uses a trust fund account to finance its operations. A trust fund has not proven to be adequate because it does not provide working capital to finance operations during low cash-flow periods and does not permit net earnings to be retained to develop such capital or to purchase capital assets.

NTIS experiences broad fluctuations in cash-flow, therefore, no reservoir of working capital exists to finance operations during times of low cash inflow. As a result NTIS must draw upon funds advanced by customers (deposit accounts) to help finance operations during these low cash-flow periods. The Department of Commerce, the Office of Management and Budget (OMB) and the General Accounting Office (GAO) all agree that this practice is undesirable and should be eliminated through the establishment of a revolving fund. The draft bill would authorize a one-time appropriation of $5,000,000 to provide a corpus for the fund. This corpus can be thought of as a line of credit. During low cash-flow periods, NTIS would draw upon this capital to finance operations. During high cash-flow periods, this capital would be replenished from revenues. The establishment of a revolving fund also will allow NTIS to modernize financial practices, match costs with revenues, allow for more accurate representation of NTIS' overall financial status and generally improve management control over operations.

In addition, notwithstanding the intent of Section 3 to recover the costs of producing NTIS' products and services from users, the current trust fund does not provide authority to purchase capital assets. Therefore, although Congress intended to have NTIS pay for itself, appropriations would have to be requested for large capital acquisitions unless this revolving fund is approved.

I will be happy to answer, in writing, any questions that the Subcommittee may have.

Mr. BROWN. Mr. Milbergs, did you wish to make a separate statement?

Mr. MILBERGS. I'll be prepared to answer questions as they come up.

Mr. BROWN. Mr. Gregg, would you like to ask a question at this point?

Mr. GREGG. Dr. Merrifield, how are you progressing with the Department of Justice on the issue of getting some agreement limiting antitrust activity in the area of R&D activity?

Dr. MERRIFIELD. Well, first, I'd like to point out that I am very much interested in this exercise and I hope that we can accomplish something pretty soon.

As you know, the antitrust laws, in my opinion, are anticompetitive now. They prevent our companies from collaborating on a scale that's equivalent to those that are mounted in the targeted industries' strategies of other countries. Therefore, they are operating, as an anticompetitive device that is forcing us to lose market share instead of the other way around.

I'd even make the point that antitrust laws are really more or less irrelevant in this period of very rapid technological change when obsolescence of technologies occurs often, before the 17-year patent life has expired.

I believe it's important that we begin to modify antitrust laws so that they do not operate negatively. To this end, we have established a task force with Justice, which has met a couple of times and we have now drafted some tentative legislation which is in the Antitrust Division now for their response. Hopefully, something will come of that.

Mr. GREGG. Well, are you getting positive feelings back from the Justice Department?

Dr. MERRIFIELD. I think so, at this point. We will have to see how they respond to the wording that we have put together.

Hopefully, something constructive will come out in the very near future.

Mr. **Gregg**. Another issue: In the metric conversion office where we spent $362,000, it sounds to me like it's basically for education on metrics.

Dr. **Merrifield**. Primarily for education of the industrial community to consider voluntary conversion to the metric system to increase exports. Of course, as a scientist, I've been working with metric systems many years. I feel it's obvious that metric conversion would proceed. In fact, I would say that we are not competitive in world markets unless we use metric units.

And this is one of our key objectives in our productivity exercises: to alert individual industries to the importance of conversion to metric systems. I think for the first time, we have very clear objectives. In fact, we've made more progress in the last 4 months than probably in the last 4 years in the public relations and educational process that we're trying to pursue.

We intend to make this a very integral part of the industrial technology partnership effort because it is essential to the operation.

Mr. **Gregg**. Why shouldn't the marketplace make the decision on metrics? Why should we spend Federal money to educate people on metrics if they are going to have to compete in the metric system? Why shouldn't they have to spend the money to educate themselves?

Dr. **Merrifield**. Well, actually, they do. In fact, it is a voluntary system, as you know. And, basically, our program is one alerting people to the importance of remaining competitive.

Mr. **Gregg**. Thank you.

Mr. **Brown**. Mr. Walgren, do you have any questions?

Mr. **Walgren**. Thank you, Mr. Chairman.

The thinking of the Metric Board—and, when we changed that into a metric office in the Commerce Department. Has the Office of Director been filled and how is it functioning?

Dr. **Merrifield**. It has been established. Dr. David Goldman from the NBS has been our Acting Director.

We are now in the process of selecting a permanent Director, but the program is ongoing and very active.

Mr. **Walgren**. How many people are involved in that?

I understand that we have a five-man staff. Are you looking for a five-man staff?

Dr. **Merrifield**. That's correct.

Mr. **Walgren**. And are they functioning?

Dr. **Merrifield**. They are all onboard and operating, right.

Mr. **Walgren**. I see.

Can you discuss a little further the Office of Competitive Assessment and the increase in its budget? Apparently, it shows a doubling in positions and a doubling in dollars. What warrants that emphasis there? What have they done that we are pursuing there so effectively?

Dr. **Merrifield**. The Office of Competitive Assessment originally was anticipated to be self-contained and to gather most of its data base and its information from existing organizations like the Bureau of Industrial Economics and National Bureau of Standards and other sources.

What we found is that the data that we require for the sophisticated studies that we are making is not really available in-house and we have to go outside for much of the data that is involved in the sensitivity analyses and the trend studies that we have been developing. Therefore, much of that money is going to be allocated to contract work outside the Government and from the private sector where it only exists. We will not be doubling the OCA staff. The proposed increase will be for additional BIE staff assigned to comprehensive assessment studies, private sector sources of data, and five to seven additional staff for OCA. The OCA staff will be responsible for interviewing, writing and editing the reports—making the strategic analyses that will result in policy options that will be useful to the Government, Congress, and to the private sector.

Mr. WALGREN. So you won't be doubling the staff, but the dollars are increased?

Dr. MERRIFIELD. That's right. We will not double the staff of OCA.

Mr. WALGREN. And how would that increase be used again?

Dr. MERRIFIELD. About $400,000 of the increase is going to be used for outside contract research, data purchases and short-term consultants which will access the data that we need to make the analyses we are looking for. And the 16 staff positions proposed in the budget will be apportioned between the OCA and BIE.

Mr. WALGREN. Thank you.

Thank you, Mr. Chairman.

Mr. BROWN. Mr. Bateman.

Mr. BATEMAN. Thank you, Mr. Chairman.

Dr. Merrifield, on page 4 at the bottom of your statement, you make reference to "total non-Government funding of new technology will significantly increase as greater use is made of the R&D limited partnership mechanism."

That followed some discussion of some initiatives that are being taken within your office. Do we have the legislation in place that is necessary for maximizing those efforts in place?

Your testimony seems to imply that the program is in place as opposed to one that is being formulated. Which comes nearer the mark?

Dr. MERRIFIELD. That's a good question. Thank you. We are operating on existing legislation and, basically, the Economic Recovery Tax Act and other incentives are in place and are very potent. Industry, particularly big companies, has not known or realized that these are in place and can be utilized for this purpose.

And so what we are doing is starting with what we have and trying to work within the antitrust laws by going through the mechanism of a limited partnership which does set up a separate legal entity. This allows companies to pool their technology effectively, without antitrust problems.

However, we have had to write a 100-page document that explains how to do this and what is necessary in order to not violate the antitrust laws. It is a very cumbersome process and, from a management point of view, is not the easiest thing to do. By the same token, the tax incentives that are in place are very good but they still leave gaps in the R&D pipeline for bringing early stage developments to the point where they're viable and can capture venture capital money.

And so we are very anxious to improve those incentives. We are trying to work with Treasury at this point to identify how best we might do that.

Mr. **Bateman**. Well, the limited partnership phenomena is not a new one, but is there something in existing law that is recognized and defined and given different treatment under antitrust tax laws if it is a potent research and development limited partnership?

Dr. **Merrifield**. Yes. Basically, the law—the original law was a 1954 law which——

Mr. **Bateman**. Yes, I ought to know all about it, but, actually, I don't.

Dr. **Merrifield**. Well, nobody else did until 1974 when a man named Snow took a tax credit for some work he was doing on an incinerator and the IRS shot him down and he took it to the Supreme Court. In 1976, the Supreme Court ruled in his favor.

That, in combination with the reduction in capital gains tax and the Economic Recovery Tax Act incentives have now spawned thousands of small startup companies. In fact, several thousand were formed last year. I screened about 1,000 myself. It's a very active program. However, the problem has been that most big companies have not recognized the existence of those incentives nor recognized that the R&D limited partnership mechanism allows them to collaborate without violating antitrust laws.

So that's the basis for the RDLP's as we call them and what we are doing in that connection.

Mr. **Bateman**. Mr. Chairman, if I have time for another question, there is also throughout much of your statement a degree of concern that technology is not resulting in the same degree of productivity as is sanctioned in the economy.

By virtue of the lack of proprietary right by the private sector, I assume—and this seems to be the context of technology that's coming from Government-oriented or Government-sponsored research and development—how does the Government handle, in terms of patentability or perfection of patents, new innovations or inventions that would qualify for a patent?

Does the Government perfect its patent and then license or franchise people in the private sector to use it on either an exclusive or nonexclusive basis?

Dr. **Merrifield**. I will ask Dr. Caponio to comment, but let me just say it hasn't been done very well in the past. We are now undertaking a major initiative. There are about 28,000 Government patents, very few of which have ever been licensed for commercial purposes.

At the present time, CUFT and the NTIS have very active programs here and they have been very successful. One of our recent patents has just generated in 6 months close to $400,000 in royalties and probably might go over $1 million the first part of the year. But, basically, this has been a weak process and what we are now trying to do is to put in a much more sophisticated screen for new ideas so that we do sift out the ones that are good. We are also trying to couple this with the search and analysis capability at NTIS to put these together in portfolios and packages that would be of significant value; particularly the R&D limited partnerships that we help set up, but also to other industrial organizations. Licensing activity won't be significantly increased.

Would you like to comment?

Mr. **Bateman**. If I might, before Dr. Caponio comments, I'm getting a thread here that perhaps we need to be more assiduous in perfecting the Government's rights to patents where patentability can be established as the foundation by which we then can license them so the private sector, through the Government's patent has a proprietary right that it can rely upon, based upon the Government patent and its license.

Doctor, am I misconceiving the thrust of your initiative?

Dr. **Caponio**. Congressman Bateman, the National Technical Information Service, as you perhaps know, is requesting an additional $385,000 for fiscal year 1984 in order to commercialize or diffuse into the private sector many of the Government-owned inventions which we are responsible for licensing.

At the present time, we do have a backlog of Government-owned inventions which have a potential commercial value. As Dr. Merrifield also pointed out, during the many years since the existence of the Patent Licensing Office or the Government Inventions Office, NTIS has perhaps licensed approximately 100.

At the present time, we have approximately 100 licensees in the United States, so much more can be done with the increase in the appropriations. We will be able to increase our efforts in commercializing many of the Government inventions.

Mr. **Bateman**. Thank you.

Dr. **Merrifield**. Mr. Milbergs would also like to add a comment.

Mr. **Milbergs**. Let me separate two issues. One is Government-owned inventions, which come about through employee inventions of Government laboratories, for example. I'd like to contrast that with the policy we had in place that started with Public Law 96-517. The Government, as you know, puts out a lot of R&D under contract or grants.

The Presidential memorandum of February 18, just reaffirms the administration's commitment to Public Law 96-517. Instead of the Government taking title to Government-funded inventions, the first right of refusal should remain with the private sector—universities, nonprofits, small business, and so on.

It is our hope that this new Presidential policy will reduce the inventory that we have to take title to and leave that title in the private sector and, thereby, the private sector would have the incentive to commercialize on their own.

Mr. **Brown**. Mr. McGrath.

Mr. **McGrath**. Thank you, Mr. Chairman.

Under OPTI, are any of your other offices within your purview, that is specifically, under OPTI—it says: identify, as an objective, regulatory, economic, and human resource barriers to productivity growth and recommend policy remedies to top administrative officials to make the economic climate more conducive to productivity growth.

Now since you are a part of the Department of Commerce, my question is: Did your office or any offices under your jurisdiction have anything to say or review with regard to the ill-conceived transfer of weather technology from your Department to the private sector? I refer to the result of the memorandum.

Dr. **Merrifield**. Well, I would have to defer to NOAA for that.

Mr. **McGrath**. My question to you is: Were you requested to look at this and to make an assessment of the proposal?

Dr. **Merrifield**. I haven't been involved in that at all.

Mr. **McGrath**. Thank you.

Mr. **Brown**. Mr. Skeen.

Mr. **Skeen**. Thank you, Mr. Chairman.

The only question I would like to ask is: You refer to the strengthening of these RDLP's. We all talk in letters around here—limited partnerships. And I'm just curious.

You say the law was put into effect in 1954. What's the status now? How many of these limited partnerships do you actually have in operation?

Dr. **Merrifield**. There are probably over 10,000 small companies that have been formed in the last 3 or 4 years, particularly since the ERTA and the capital gains tax changes have occurred. Just an explosion of these things.

There are now 650 or thereabouts—small venture capital companies. They have about $7 billion in assets. They grew about a billion and a half last year. Astonishing explosion in this area of small start-up companies—many of them growing 20 to 100 percent a year. It's a very interesting phenomenon we see.

Mr. **Skeen**. A 100-percent growth a year?

Dr. **Merrifield**. Yes, but they may not have a very long life because the technology changes so rapidly, but it's a very interesting thing.

Mr. **Skeen**. This growth has been spurred mainly by tax advantage?

Dr. **Merrifield**. That's right.

Mr. **Skeen**. Or has it been a positive program from your office?

Dr. **Merrifield**. No. It preceded our office and it actually started 2½ or 3 years ago and is growing rather rapidly. But what our contribution has been, primarily, is to extend this beyond the small startup stage into limited partnerships that can involve big companies.

For example, no U.S. company in the civil aircraft business can bet its company on the next generation aircraft. One of the things we're trying to do is to get the Boeings and Lockheeds and McDonnell Douglases, the Air Force and so forth together in a consortium that would identify and design that next generation utilize, where possible, these tax incentives to distribute the risk.

There are many examples of this kind. The semiconductor industry is another area where collaborative effort is going to be necessary for survival in many ways.

Mr. **Skeen**. But you have a very deliberate program, then?

Dr. **Merrifield**. Oh, yes.

Mr. **Skeen**. Thank you, Mr. Chairman.

Mr. **Brown**. Dr. Merrifield, I am sure you are well aware of the fact that we are having an agonizing reappraisal of the whole of U.S. industry and commerce to see what has gone wrong and what we can do to improve its international competitiveness, productivity, and so forth. Your office may be the U.S. counterpart to the Ministry of International Trade and Industry in Japan.

Dr. **Merrifield**. With some differences, I hope.

Mr. **Brown**. Of course—some differences.

There is a plethora of legislation that has been introduced seeking to move this country toward reestablishing its historic leadership role in industrial productivity. You come to us with a piddling $3 million-plus budget, and I ask you: Do you think this is an adequate response to the problem that faces the United States?

Dr. **Merrifield**. That's a good question. I think for startup activities it has been adequate. We see ourselves primarily as a catalytic force that brings other enormous resources together and concentrates them where they are needed. Rather than massive Federal funding directly, what we want to do is multiply the funding through the private sector.

And I think that the limited partnership concept has that potential, way beyond any direct funding that the Government could otherwise do. It is a catalytic effort and at this point we are doing the best we can. That's about where we are.

Mr. **Brown**. Well, I think that's a responsive answer. I think it puts a great deal of hope in catalysis but it may be justified.

You refer to this as a startup operation. I'm sure you know that the Congress passed and the President signed—the previous President—the Stevenson-Wydler Act in 1980 which authorized just for that one component of your activity a budget of $74 million this year. And this is the third or fourth year of the $285 million, 5-year authorization.

So it's not exactly a startup at this point, is it?

Dr. **Merrifield**. It's a startup since I've been here and, of course, what we've done is to restructure within the guidelines under which we are operating.

Mr. **Brown**. That's a polite way to say you've cut the heart out of it, isn't it?

Dr. **Merrifield**. Well, I think we can be quite confident that the catalytic efforts that we are mounting will really accomplish the spirit of Stevenson-Wydler, with which I very much agree, but we will go well beyond that in terms of its total impact.

I can see the tax incentives that are in place. If we can improve them a little bit and get the barriers out of the way, we can multiply the amount of R&D we do in this country within the next 5 to 10 years. That's very significant.

Mr. **Brown**. Isn't that what the President's tax program was intended to accomplish in 1981?

Dr. **Merrifield**. Yes.

Mr. **Brown**. And has it accomplished that?

Dr. **Merrifield**. I think it will begin to.

Mr. **Brown**. In other words, it hasn't accomplished it, but you hope it will?

Dr. **Merrifield**. I think that the high interest rates have impeded it to some degree, but I also think the initiatives that we are taking can accomplish a good deal along this line.

Mr. **Brown**. How many of the assessments that you mentioned in the Office of Competitive Assessment do you have completed or well underway or expected to be completed this fiscal year?

Dr. MERRIFIELD. We have completed one which is the petrochemical assessment, and that will be issued shortly. We have a civil aircraft one in the final stage—a draft stage. The one on telecommunications, which is also an indepth study, is in process.

In addition to that, we have about a dozen or more of these that relate to machine tools, peripheral equipment, computers, engineering materials like ceramics and composites, international construction, telecommunications, agribusiness, pharmaceuticals, energy storage and transmission, and so forth.

Mr. BROWN. Would it be an undue burden to ask you to transmit copies of those completed assessments to this subcommittee?

Dr. MERRIFIELD. Be delighted when they are available.

Mr. BROWN. We'd like very much to see them.

Dr. MERRIFIELD. Indeed.

Mr. BROWN. All of that could be done under the aegis of the Stevenson-Wydler Act, of course.

Dr. MERRIFIELD. It is, indeed.

Mr. BROWN. You referred to the President's establishing a commission of industrial competitiveness and planning a White House productivity conference later this year. What is the status of those two very laudable initiatives?

Dr. MERRIFIELD. Both of them are well along. The White House Conference will be held some time in October but, preceding that, we expect to mount a number of regional miniconferences, which will generate a lot of the data that will go into that final conference and we are planning those very actively.

The White House Commission is in process and will be coming into being shortly, as soon as all the approvals have been completed. And by approvals, I mean the individual people that have been designated or identified for membership. We expect that it will report to the Cabinet Council on Commerce and Trade. Secretary Baldrige is Chairman of that Council.

Mr. BROWN. Well, I will not underestimate the potential of either of those two initiatives. They can be very great. They can indicate that the Federal Government desires to take a leadership role in this large task, and you and the Secretary should be in the forefront of that, I would think. I trust you will be.

Dr. MERRIFIELD. Well, that would be our intention, and we are as enthusiastic about it as anyone can be.

Mr. BROWN. With regard to the program involving the industrial technology partnerships, could you indicate, or do you happen to know, whether this highly publicized effort in the computer industry—a new corporation called MCC, I think—is organized in accordance with that legal framework or is it a different one?

Dr. MERRIFIELD. It is not. It was undertaken before I got to them. It really is a direct funding by individual companies of research that is going on now in several universities. It has about $11 million that they are allocating, which is a very small number relative to the need.

And I think that it also has potential antitrust problems downstream. And what I am now doing is working with the semiconductor industry and electronic industry associations to mount much more elaborate limited partnerships that might fund something in the order of several hundred to $500 million in specific programs such as the million-bit dynamic random access memory chip or whatever.

And I think that it's very important that we get something like that underway. However, realistically, while I can lead the horse to the water; the animal has to drink for itself. And it takes some time to get through that.

Mr. **BROWN**. You are not condemning this initiative on the part of the companies involved, are you?

Dr. **MERRIFIELD**. Absolutely not. In fact, it can be quite complimentary to some of the other things that we would do otherwise.

Mr. **BROWN**. Is there any way in which you can extend assistance of the same general sort that you would extend to the industrial technology partnerships in overcoming certain governmental barriers to their operation—for example, the antitrust problem that you referred to?

Dr. **MERRIFIELD**. I would hope so and that is part of our initiative with the Justice Department. I would hope that we would have some very significant modifications of antitrust laws that would allow basically any group of companies to at least collaborate at the R&D level and perhaps go beyond that where it's necessary.

Mr. **BROWN**. I'm not at all critical of the work that you have described under your jurisdiction, Dr. Merrifield. I think that you are a highly competent person to provide the leadership and guidance to this—what I consider—limited program.

But let me ask you: Is there a possibility that, after we have evaluated—we'll say the White House Productivity Conference scheduled for later this year, or the Commission that you referred to—evaluated the scope of your activities as failing to meet the need, do you feel this administration would consider more ambitious programs to solve this very large national problem?

Dr. **MERRIFIELD**. I would hope that this would be perceived as a very important initiative. In fact, at the present time, it's one of the top priorities of the Commerce Department and it has received rather significant support from the Vice President and from some other members of the White House. So I do believe the awareness of the importance of increased productivity and collaborative efforts are emerging and I think the support will be there.

Mr. **BROWN**. Well, you don't completely satisfy me with your response. But I don't presume that you intended to. [Laughter.]

This would be a good time, I think, since we have a rollcall vote, to excuse you. And I do appreciate your statement.

Dr. **MERRIFIELD**. Thank you, Mr. Chairman.

Mr. **BROWN**. This clarifies the situation very well and, as soon as the rollcall is completed, we will resume with Dr. Ambler, who I see is ready and waiting to go.

We'll recess for about 10 minutes.

[The subcommittee went into a short recess for a rollcall.]

Mr. **REID**. The subcommittee on Science, Research, and Technology will be called to order.

It is with pleasure I introduce to the committee Dr. Ernest Ambler, Director of the National Bureau of Standards.

With him is Dr. John W. Lyons, representing National Engineering Laboratory, Dr. Donald R. Johnson, representing National

Measurement Laboratory, and Mr. James Burrows, Director of the Institute for Computer Sciences and Technology.

I would indicate that Dr. Johnson, who has served for some months as Acting Director of the National Measurement Laboratory, has, like Dr. Caponio, just this week had the "acting" removed from his title and we congratulate you on this new and more permanent appointment.

Dr. Ambler, please proceed.

Dr. AMBLER. Thank you.

I appreciate the opportunity to appear before you today in support of the administration's request for authorization of appropriations for the programs and activities of the National Bureau of Standards in fiscal years 1984 and 1985.

You did already introduce the members of the management of the National Bureau of Standards who are with me except the person on my left, who is Mr. Kammer, the Deputy Director.

Now, with your permission, Mr. Chairman, I will summarize the written statement and ask that the written statement be included in the record.

Mr. REID. That will be the order, following your testimony.

[The biographical sketch of Dr. Ambler follows:]

Dr. Ernest Ambler

Dr. Ernest Ambler became the 8th Director of the National Bureau of Standards in February 1978. At the request of Secretary Baldrige he has continued as Director under the Reagan Administration.

As Director of NBS Dr. Ambler leads the nation's central reference laboratory. NBS provides measurement methods, standards, and data that are used in industry, commerce, government and universities. NBS also applies its technical resources in helping solve problems of broad national importance. The Bureau's headquarters are located in Gaithersburg, Maryland, with a second laboratory at Boulder, Colorado. Total staff numbers about 3200, over half working in scientific and technical areas.

Dr. Ambler joined NBS in 1953, and has worked throughout his career to make NBS an increasingly valuable scientific and technical resource for industry, business, government, education, and the public. As a scientist, he has contributed directly to the state-of-the-art in measurement technology. His expertise in nuclear physics and cryogenics formed the basis in 1956 for a cooperative effort that disproved the law of parity conservation, a concept that nuclear scientists had adhered to for more than 30 years. This pioneering project confirmed experimentally the theoretical work of Nobel Prize winners T. D. Lee and C. N. Yang.

As an administrator, Dr. Ambler has helped guide Bureau operations and policies to improve the efficiency with which NBS fulfills its mission. His management responsibilities began in 1961 when he became Chief of the Cryogenic Physics Section. Four years later, he was appointed Chief of the Inorganic Materials Division. In 1968, as Director of the Institute for Basic Standards, he assumed responsibility for directing the most basic of NBS research activities: developing and maintaining standard and measurement techniques for such quantities as length, mass, time and frequency, and temperature.

In 1973 he was appointed Deputy Director, and Acting Director in 1975.

Among Dr. Ambler's continuing concerns is the Bureau's role in international science. He has long acknowledged that through its mission and diversity, the Bureau can act as a prime agent in international scientific cooperation and can support U.S. foreign commerce through participation in international standardization activities. In 1972, Dr. Ambler was elected to serve as the U.S. representative to the International Committee of Weights and Measures (CIPM), the executive body of the General Conference of Weights and Measures. In addition, he serves as chairman of the Consultative Committee on Standards for Measuring Ionizing Radiations of the CIPM. In September 1981 he became the Department of Commerce member of the Board of Governors of the Israel/U.S. Binational Industrial Research and Development Foundation.

Dr. Ambler is a member of the American Association for the Advancement of Science, a fellow of the American Physical Society, and as Director of NBS is ex officio President of the National Conference on Weights and Measures.

Dr. Ambler is the recipient of numerous honors, awards, and fellowships including: The Department of Commerce Gold Medal, the NBS Stratton Award, Nuffield Fellow of Oxford University, the John Simon Guggenheim Memorial Foundation Fellowship Award, the John Price Wetherill Medal of the Franklin Institute, the Washington Academy of Sciences Award, the Arthur S. Flemming Award, the William A. Wildhack Award, and the President's Award for Distinguished Federal Civilian Service. He has authored 51 publications and holds a patent for low temperature refrigeration apparatus and processes.

Born in Bradford, Yorkshire, England, in 1923, Dr. Ambler earned his B.A., M.A., and Ph.D. in physics at Oxford University before coming to the National Bureau of Standards. He became a United States citizen in 1958. Dr. Ambler and his wife, Alice Seiler Ambler, a former staff member in the NBS Heat and Building Research Divisions, were married in 1955. They live in Bethesda, Maryland, and have two sons, Christopher and Jonathan.

STATEMENT OF DR. ERNEST AMBLER, DIRECTOR, NATIONAL BUREAU OF STANDARDS, ACCOMPANIED BY RAYMOND G. KAMMER, DEPUTY DIRECTOR, NATIONAL BUREAU OF STANDARDS

Dr. AMBLER. For fiscal year 1983 the National Bureau of Standards is operating at an annual rate of $117,861,000 as authorized under the second continuing resolution.

It is estimated that our reimburseable work will total approximately $74.5 million.

And I might add here, Mr. Chairman, that, at the request of this committee, our reimbursable work is now displayed in the budget submission to Congress.

The proposed NBS budget for fiscal year 1984 includes an increase for cost-of-living and built-in changes of $5,908,000 and decreases totaling $25,069,000 and 179 positions in the programs supported by direct appropriations.

The net reduction from the fiscal year 1983 level is $19,161,000.

With the funding recommended in the budget, NBS will emphasize measurement standards, data and test methods. We will continue to work on a number of nationally important programs, particularly automated manufacturing and electronics, in which this committee has expressed interest in the past, and also in materials.

A decrease totaling $9.1 million reflects the proposal to eliminate the Center for Building Technology and the Center for Fire Research. The budget includes a $7 million decrease for ADP standards activity in the Institute for Computer Sciences and Technology.

I have been asked by the Department, Mr. Chairman, to report that it is completing the review of all DOC programs relevant to telecommunications and information systems with the intention of improving cooperative efforts and information exchange and policy planning.

As part of this review, additional resources for ICST are being discussed within the administration. The Department will forward results of the review and its effect on our 1984 budget request later this spring.

The fiscal year 1984 budget proposes a reduction of $3.2 million as a result of fee increases for programs that provide benefits to identifiable users, such as reference materials, measurement assurance, and laboratory accreditation programs.

The last two programs will continue to the extent that users are willing to bear the developmental costs as well as the operating costs.

This user-fee package assumes enactment of the proposed legislation which would permit NBS to retain income for use in replacing standard reference materials inventories instead of the current practice which requires appropriated support.

Funds totaling $2.6 million are proposed for reduction as a result of completing objectives for the recycled oil program, completing initial equipment acquisitions for the automated manufacturing research facility and acquiring support for that facility from other Federal agencies, particularly the Defense Department and the private sector.

A total of $3.8 million will have been invested in equipment for that facility by the end of fiscal year 1983.

A reduction of $1.2 million is possible from the conversion of the nonmetallic materials program to reimbursable funding and from a lower central planning effort.

A one-time savings of $2 million will result from the delay in the NBS computer acquisition. The Department has reviewed NOAA and NBS computer needs and has directed the establishment of a consolidated computer facility at NBS in Gaithersburg to meet our requirements. Planning for acquisition has now begun.

A number of areas which have been of special interest and concern to the members of this subcommittee are discussed in my written statement, Mr. Chairman. I won't repeat them here, and so I will conclude the summary and will be glad to respond to any questions you might have.

[The prepared statement of Dr. Ambler follows:]

U.S. DEPARTMENT OF COMMERCE
STATEMENT OF ERNEST AMBLER, DIRECTOR
NATIONAL BUREAU OF STANDARDS
BEFORE THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY
ON AUTHORIZATION OF APPROPRIATIONS FOR THE ACTIVITIES OF
THE NATIONAL BUREAU OF STANDARDS

MARCH 22, 1983

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE:

I AM PLEASED TO APPEAR BEFORE YOU TODAY IN SUPPORT OF THE ADMINISTRATION'S REQUEST FOR AUTHORIZATION OF APPROPRIATIONS FOR THE PROGRAMS AND ACTIVITIES OF THE NATIONAL BUREAU OF STANDARDS (NBS) IN FISCAL YEARS 1984 AND 1985.

DRAFT LEGISLATION REQUESTING THESE AUTHORIZATIONS WAS TRANSMITTED TO THE CONGRESS BY THE SECRETARY OF COMMERCE ON FEBRUARY 10, 1983.

I AM ACCOMPANIED BY MY DEPUTY DIRECTOR, MR. RAYMOND G. KAMMER; BY DR. DONALD R. JOHNSON, ACTING DIRECTOR OF THE NATIONAL MEASUREMENT LABORATORY; BY DR. JOHN W. LYONS, DIRECTOR OF THE NATIONAL ENGINEERING

Laboratory; and by Mr. James H. Burrows, Director of the Institute for Computer Sciences and Technology. Dr. Johnson, Dr. Lyons, and Mr. Burrows will summarize the activities, accomplishments, and plans for each of those organizational units.

Overview of the National Bureau of Standards

The National Bureau of Standards was created by the Act of March 3, 1901 (15 U.S.C. 271-278h) known as the NBS Organic Act. That Act sets out the authority under which we provide measurement standards, measurement services, reliable data, test methods, and research in support of the Nation's efforts in commerce, science, and technology. We exercise these functions for the U.S. Government, states, localities, any scientific or educational institution, firm, corporation, or individual both in the United States and in friendly countries. This is a very broad statement of our mission.

I find it useful to consider the motivation for creating and supporting the National Bureau of Standards and the contribution NBS makes to the goals of the Department of Commerce as a means of helping to define programs in more specific terms. We support economic recovery, growth, and the competitiveness of the United States in the world economy. We direct our programs to support science, and specific national goals as defined by the Administration and Congress. Our programs are often done in collaboration with other Federal agencies.

THESE DRIVING FORCES HELP TO DEFINE THE BOUNDS OF THE NBS MISSION AND THE SPECIFIC ROLES THAT ADDRESS THAT MISSION. FIRST, NBS PROVIDES A BASIS FOR MEASUREMENT THROUGHOUT THE U.S. BY MEANS OF STANDARDS, DATA, AND TEST METHODS; BASIC STANDARDS SUCH AS LENGTH AND FREQUENCY; DATA SUCH AS PROPERTIES OF MATERIALS; AND TEST METHODS SUCH AS METHODS FOR MEASURING SPREADING RESISTANCE IN A CHIP OF SILICON. IN ESSENCE, WE ARE THE CENTRAL NATIONAL LABORATORY FOR MEASUREMENT SCIENCE.

NBS IS NOW PURSUING SEVERAL PROGRAMS THAT ARE DESIGNED TO SUPPLY AN EXPANDED RANGE OF STANDARDS, DATA, AND TEST METHODS NEEDED BY U.S. INDUSTRIES. THESE PROGRAMS INCLUDE SEMICONDUCTOR ELECTRONICS, METALS PROCESSING, AND AUTOMATED MANUFACTURING.

THE SEMICONDUCTOR ELECTRONICS PROGRAM FOCUSES ON VERY LARGE SCALE INTEGRATED CIRCUITS AND ON A VARIETY OF MEASUREMENTS USED TO CHARACTERIZE THESE CIRCUITS. THIS PROGRAM PROVIDES QUALITY CONTROL TOOLS TO THE INDUSTRY AND THE TECHNICAL BASIS FOR SETTING AND SATISFYING PRODUCT SPECIFICATIONS THROUGH VOLUNTARY STANDARDS ORGANIZATIONS. PERFORMANCE OF THIS WORK REQUIRES NEW MEASUREMENT SCIENCE BECAUSE OF THE GREATLY REDUCED DIMENSIONS AND VASTLY INCREASED COMPLEXITY OF THESE MICROCIRCUITS. THESE EFFORTS ASSIST U.S. INDUSTRIES IN PRODUCING HIGH QUALITY PRODUCTS TO MEET INCREASING FOREIGN COMPETITION.

THE METALS PROCESSING PROGRAM IS AIMED AT PROVIDING THE MEASUREMENT PRODUCTS AND SERVICES NEEDED BY THE METALS INDUSTRY TO FOSTER A MORE RAPID ADOPTION OF ADVANCED PROCESSING TECHNOLOGIES. A major part of the program is the development and dissemination of evaluated alloy phase diagrams which allow the metals industry to investigate the development of new rapidly-solidified alloys. Such alloys represent one group of a range of new materials that will be used at an increasing rate because of better performance characteristics, such as higher strength and corrosion resistance, and because of lower concentrations of scarce or critical alloy materials.

The automated manufacturing program carries out activities which will enable the private sector to make discrete parts to the required accuracy when using fully automated manufacturing systems. We are concentrating on the dimensional measurements needed for an unmanned work station and software to enable microprocessors from different suppliers to communicate with one another. We have made good progress within the past year in establishing our Automated Manufacturing Research Facility and will shortly have two complete manufacturing cells with robots and machining centers available for our research.

A second role for NBS is to respond to specific legislative assignments and the needs of other Government agencies. The Standard Reference Data Act is an example of a legislative assignment, while work with the Department of Defense to tie defense operational calibrations to the national standards is an example of work for other Government agencies.

As part of the 1984 budget process, we have undertaken an extensive review of the programs conducted in this area. We have examined the adequacy of NBS support, the changing environment and the resulting effects on program requirements, and the responsibilities of Federal versus private sector and state and local governments. This review has led to:

(1) an increase of 97 positions available to NBS to respond to measurement-related work funded by other government and private sector entities,

(2) a determination that the computer industry should take a more active role in supporting computer sciences and technology, and

(3) a determination that the private sector and state and local governments should support fire and building technology research programs.

Authorization Request

The enactment of an authorization of appropriations for the activities of NBS is needed for fiscal year 1984 and beyond. On February 10, the Secretary of Commerce submitted draft legislation which would, if enacted, authorize appropriations for NBS and the Office of Productivity, Technology and Innovation for fiscal years 1984 and 1985. A copy of the draft bill, and an accompanying Statement of Purpose and Need, and letters of transmittal to the Speaker of the House and the President of the Senate are attached.

Section 2 of our draft bill authorizes a total NBS appropriation, exclusive of funding for salary adjustments, of $98,700,000 for fiscal year 1984. This includes in section 2(a) $48,709,000 for Measurement Research and Standards; in section 2(b) $18,507,000 for Engineering Measurement and Standards; in section 2(c) $3,000,000 for Computer Science and Technology; in section 2(d) $12,407,000 for Core Measurement Research for New Technologies; in section 2(e) $7,672,000 for the Technical Competence Fund; and in section 2(f) $8,405,000 for Central Technical Support.

Section 3 of our draft bill authorizes appropriations to the Secretary of Commerce of $700,000 for fiscal year 1984 and such sums as may be necessary for 1985 for expenses incurred by NBS outside the United States in foreign currency in excess of normal requirements as determined by the Secretary of Treasury.

Section 4 authorizes appropriations of $3,752,000 for fiscal year 1984 and such sums as may be necessary for fiscal year 1985 to the Secretary for the activities of the Office of Productivity, Technology and Innovation. Dr. Bruce Merrifield, Assistant Secretary of Commerce for Productivity, Technology, and Innovation, has provided a written statement to this Committee describing the activities and programs of that Office.

Section 5 authorizes appropriations of such sums as may be necessary for fiscal years 1984 and 1985 to make salary adjustments. Section 6 makes appropriations available for obligation and/or

EXPENDITURE FOR WHATEVER PERIOD IS SO SPECIFIED IN THE ACT MAKING THE APPROPRIATION.

SECTION 7 PROPOSES TO AMEND SECTION 12 (F) OF THE NBS ORGANIC ACT TO ALLOW NET INCOME TO BE USED TO REPLACE EQUIPMENT AND INVENTORIES BEFORE THE NET SALES PROCEEDS ARE PAID INTO THE GENERAL FUND OF THE TREASURY. UNDER EXISTING AUTHORITY, THE NBS WORKING CAPITAL FUND MAY ONLY RECOVER ITS ORIGINAL INVESTMENT IN EQUIPMENT AND INVENTORIES AND NOT THE ACTUAL REPLACEMENT COSTS. CURRENT REPLACEMENT COSTS OFTEN FAR EXCEED THE ORIGINAL INVESTMENTS. SINCE THE RECOVERED AMOUNTS ARE INSUFFICIENT FOR REPLACEMENT OF NEW EQUIPMENT AND INVENTORIES AT CURRENT PRICES, NBS MUST THEN REQUEST ADDITIONAL APPROPRIATIONS FOR RESTORATION OF THE WORKING CAPITAL FUND IN ORDER TO MAINTAIN ITS EQUIPMENT AND INVENTORY LEVELS. IN THE CASE OF STANDARD REFERENCE MATERIALS (SRM'S), THE NEED FOR ADDITIONAL APPROPRIATIONS TO COVER REPLACEMENT COSTS COULD BE AVOIDED BY RAISING THE SRM SALES FEES CHARGED. HOWEVER, AT PRESENT NBS LACKS THE AUTHORITY NEEDED TO RETAIN THE PROCEEDS FROM SUCH INCREASES. SECTION 7 OF OUR PROPOSED BILL PROVIDES THAT AUTHORITY. THE FISCAL YEAR 1984 BUDGET REFLECTS THIS PROPOSAL BY SHOWING A DECREASE FOR TRANSFERS TO THE WORKING CAPITAL FUND FOR SRM PRODUCTION.

FISCAL YEAR 1984 BUDGET

THE FISCAL YEAR 1984 BUDGET IS THE RESULT OF THE ADMINISTRATION'S CAREFUL EVALUATION OF THE BUREAU'S PROGRAMS AND PRIORITIES AND

INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY

THE BUDGET INCLUDES A $7 MILLION DECREASE FOR ADP STANDARDS ACTIVITY IN ICST. THIS REFLECTS THE ADMINISTRATION'S VIEW THAT THE PRIVATE SECTOR SHOULD TAKE GREATER RESPONSIBILITY FOR SUPPORTING THE VOLUNTARY STANDARDS PROCESS BECAUSE OF THE BENEFIT THAT ACCRUES TO THE ADP INDUSTRY. HOWEVER, I HAVE BEEN ASKED BY THE DEPARTMENT TO REPORT THAT IT IS COMPLETING A REVIEW OF ALL DOC PROGRAMS RELEVANT TO TELECOMMUNICATIONS AND INFORMATION SYSTEMS WITH THE INTENTION OF IMPROVING COOPERATIVE EFFORTS AND INFORMATION EXCHANGE AND POLICY PLANNING. AS PART OF THIS REVIEW, ADDITIONAL RESOURCES FOR ICST ARE BEING DISCUSSED WITHIN THE ADMINISTRATION. THE DEPARTMENT WILL FORWARD RESULTS OF THE REVIEW AND ITS EFFECT ON OUR 1984 BUDGET REQUEST LATER THIS SPRING.

USER FEES

THE FISCAL YEAR 1984 BUDGET PROPOSES A REDUCTION OF $3.2 MILLION AS A RESULT OF FEE INCREASES FOR PROGRAMS THAT PROVIDE BENEFITS TO IDENTIFIABLE USERS. THESE PROGRAMS INCLUDE CALIBRATIONS, TRAINING SERVICES AND MATERIALS, AND PARTICIPATION IN MEASUREMENT ASSURANCE AND LABORATORY ACCREDITATION PROGRAMS. THESE PROGRAMS WILL CONTINUE TO THE EXTENT THAT USERS ARE WILLING TO BEAR DEVELOPMENTAL COSTS AS WELL AS OPERATING COSTS. THIS USER FEE PACKAGE ASSUMES ENACTMENT OF THE PROPOSED LEGISLATION MENTIONED EARLIER CONCERNING REPLACEMENT COSTS FOR STANDARD REFERENCE MATERIALS.

Recycled Oil/Automated Manufacturing

Funds totaling $2.6 million are proposed for reduction as a result of completing objectives for the recycled oil program, completing initial equipment acquisitions for the Automated Manufacturing Research Facility (AMRF), and acquiring support for AMRF facility operation from other Federal agencies, primarily the Defense Department, and the private sector. A total of $3.8 million will have been invested in equipment for the AMRF by the end of fiscal year 1983.

Nonmetallic Materials/Central Planning

A reduction of $1.2 million is possible from the conversion of the Nonmetallic Materials program to reimbursable funding from other agencies and from a lower central planning effort.

In its report following the Authorization Hearings last year, this Committee stressed the importance of careful planning and urged us to make a significant effort to look beyond the annual budget-authorization-appropriations cycle so we can be prepared to meet the challenges of future years. I want to assure you today that our central planning effort will continue as an integral part of our management function supported by overhead. We will continue to update our long-range plan and conduct studies to anticipate the needs of emerging technologies as well as to assess the impacts of our programs. During the past year we completed a major planning study on the technical developments and future measurements needs in the area of Biotechnology. This is likely to be one of the most significant

INDUSTRIAL TECHNOLOGIES IN THE NEXT SEVERAL DECADES IMPACTING THE FIELDS OF CHEMICALS, ENERGY, HEALTH CARE, FOOD PROCESSING, AND AGRICULTURE.

COMPUTER ACQUISITION

A ONE-TIME SAVINGS OF $2 MILLION RESULTS FROM THE DELAY IN THE NBS COMPUTER ACQUISITION. THE DEPARTMENT HAS REVIEWED NOAA AND NBS COMPUTER NEEDS AND HAS DIRECTED THE ESTABLISHMENT OF A CONSOLIDATED COMPUTER FACILITY AT NBS IN GAITHERSBURG TO MEET REQUIREMENTS. WHILE A FEW ADMINISTRATIVE DETAILS HAVE NOT YET BEEN RESOLVED, PLANNING FOR ACQUISITION HAS BEGUN.

AREAS OF SUBCOMMITTEE CONCERN

I WOULD NOW LIKE TO DISCUSS A NUMBER OF AREAS WHICH HAVE BEEN OF SPECIAL INTEREST AND CONCERN TO THE MEMBERS OF THIS SUBCOMMITTEE. I HAVE ALREADY MENTIONED OUR PLANS FOR THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY AND FOR MAINTAINING A LONG-RANGE PLANNING CAPABILITY. OTHER AREAS INCLUDE OUR OFFICE OF WEIGHTS AND MEASURES, THE OFFICE OF PRODUCT STANDARDS POLICY, OUR EFFORTS IN OUTREACH TO THE ENGINEERING COMMUNITY, OUR RESEARCH FOR THE HANDICAPPED, THE CONGRESSIONAL FLOORS IN OUR FISCAL YEAR 1983 BUDGET, AND OUR OVERHEAD ACTIVITIES.

OFFICE OF WEIGHTS AND MEASURES

THE BUREAU HAS RESPONDED TO THE SUBCOMMITTEE'S RECOMMENDATION THAT SUPPORT FOR THE WEIGHTS AND MEASURES PROGRAM BE STRENGTHENED. THE RELOCATION OF THE OFFICE OF WEIGHTS AND MEASURES INTO THE DIRECTOR'S OFFICE IS NOW COMPLETE. THIS HAS ENABLED US TO PROVIDE MORE MANAGERIAL SUPPORT FOR THE NATIONAL CONFERENCE OF WEIGHTS AND MEASURES (NCWM). AS DIRECTED BY THE SUBCOMMITTEE, WE SUBMITTED A PLAN OF WORK FOR THE OFFICE IN FISCAL YEAR 1983, WITH PROJECTIONS FOR FISCAL YEARS 1984 AND 1985. IN ACCORDANCE WITH THIS PLAN, NBS ISSUED A GRANT OF $159,000 TO NCWM TO PROVIDE FOR DEVELOPMENT AND IMPLEMENTATION OF A NATIONAL TRAINING PROGRAM FOR WEIGHTS AND MEASURES OFFICIALS. A FURTHER $250,000 WAS PROVIDED TO BEGIN DEVELOPMENT OF A NATIONAL TYPE EVALUATION PROGRAM THAT WILL PROVIDE FOR DESIGN AND PERFORMANCE EVALUATIONS OF NEW WEIGHING AND MEASURING DEVICES.

OFFICE OF PRODUCT STANDARDS POLICY

THE OFFICE OF PRODUCT STANDARDS POLICY (OPSP) WAS RELOCATED INTO THE DIRECTOR'S OFFICE, WHERE IT RECEIVES THE DIRECT SUPPORT AND ENCOURAGEMENT OF THE SENIOR NBS MANAGEMENT TEAM. IN ADDITION TO THE OFFICE OF WEIGHTS AND MEASURES, OPSP HAS RESPONSIBILITIES IN THE AREAS OF STANDARDS AND CODES INFORMATION, LABORATORY ACCREDITATION, STANDARDS COORDINATION AND MANAGEMENT, AND INTERNATIONAL AND LEGAL METROLOGY. DURING THE PAST YEAR, FOR EXAMPLE, OPSP COMPLETED THE DESIGN OF A QUICK RETRIEVAL SYSTEM FOR STANDARDS INFORMATION STORED ON MICROFICHE. IT OFFERS LABORATORY ACCREDITATION PROGRAMS ON A REIMBURSABLE BASIS FOR THERMAL INSULATION, CONCRETE, CARPETS, AND stoves. In conjunction with the Nuclear Regulatory Commission and private sector laboratories, it developed an accreditation program for personnel dosimeters. In the area of international trade, NBS entered into an agreement with Australia which provides reciprocal acceptance of nationally accredited laboratories with that country. Several similar agreements with other countries are pending and are expected to be signed shortly.

Outreach to the Engineering Community

We took specific steps during the past year to emphasize the close working relationship with outside practitioners and engineers who put our scientific results into practice.

The Industrial Research Institute is made up of about 270 major companies with interest in the performance and management of research and development. I attended their annual meeting in October 1982 and members of their Federal Science and Technology Committee visited NBS last month. About 35 of their representatives came to NBS in 1980 to review programs related to nondestructive evaluation, automated manufacturing, and food measurement technology.

We recently signed two cooperative agreements with industry that set up joint programs in materials science. The American Ceramic Society agreed to expand a cooperative effort to provide evaluated phase diagrams for use by ceramic scientists and engineers. We will be responsible for overall guidance on technical aspects and

RELIABILITY OF THE DATA EVALUATIONS. THE SOCIETY WILL PRODUCE AND MARKET PUBLICATIONS REFERENCING THE DATA AND SPONSOR SEVERAL RESEARCH ASSOCIATES TO HELP COMPILE THE DATA IN BOTH HARD COPY AND COMPUTER RETRIEVABLE FORM.

THE NATIONAL ASSOCIATION OF CORROSION ENGINEERS RECENTLY AGREED TO FUND A JOINT PROGRAM WITH NBS TO PROVIDE INDUSTRY WITH CORROSION DATA NEEDED FOR DESIGN OF INDUSTRIAL PLANTS, STRUCTURES, AND EQUIPMENT. EVALUATED THERMODYNAMIC AND KINETIC DATA WILL BE AVAILABLE THROUGH THE NATIONAL STANDARD REFERENCE DATA SYSTEM.

DURING THE PAST EIGHTEEN MONTHS, THERE WAS EXTENSIVE INTERACTION BETWEEN THE STAFF OF OUR AUTOMATED MANUFACTURING RESEARCH PROGRAM AND THE INDUSTRY. OUR SENIOR STAFF MADE OVER 200 VISITS TO OUTSIDE INDIVIDUALS AND ORGANIZATIONS TO DISCUSS TECHNICAL ISSUES AND RESEARCH COLLABORATION. WE RECEIVED WELL OVER 1,000 VISITORS DURING THIS PERIOD. IN NOVEMBER AND DECEMBER 1982, WE HELD TWO MAJOR CONFERENCES CO-SPONSORED WITH THE DEPARTMENT OF THE NAVY TO RECEIVE INDUSTRY RECOMMENDATIONS FOR RESEARCH AND DEVELOPMENT PROJECTS AND TO LEARN OF CURRENT AND PLANNED RESEARCH NATIONWIDE. WE CURRENTLY HAVE TEN RESEARCH ASSOCIATES REPRESENTING SEVERAL MACHINE AND CONTROLLER MANUFACTURERS. THE INDUSTRY ALSO CONTRIBUTED SEVERAL MACHINES ON LOAN TO THE PROGRAM, VALUED AT OVER $500,000.

FRACTURE STUDY

YOU MAY ALSO BE INTERESTED IN THE RESULTS OF OUR RECENTLY COMPLETED FRACTURE STUDY. IN SEPTEMBER, 1979, CHAIRMAN JEROME AMBRO OF THE SUBCOMMITTEE ON NATURAL RESOURCES AND ENVIRONMENT AND CHAIRMAN GEORGE BROWN OF THE SUBCOMMITTEE ON SCIENCE, RESEARCH, AND TECHNOLOGY OF THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY WROTE ME REQUESTING THAT NBS CONDUCT A STUDY OF THE ECONOMIC AND SAFETY COSTS OF FRACTURE. NBS AND BATTELLE LABORATORIES CARRIED OUT THE STUDY WITH ADDITIONAL SUPPORT FROM THE DEPARTMENT OF ENERGY, THE NATIONAL SCIENCE FOUNDATION, THE DEPARTMENT OF THE INTERIOR, AND THE DEPARTMENT OF DEFENSE. THE STUDY INCLUDED ALL MATERIALS, ALL TYPES OF STRUCTURES, AND BOTH FRACTURE OCCURRENCE AND FRACTURE PREVENTION COSTS. I AM PLEASED, WITH YOUR PERMISSION, MR. CHAIRMAN, TO TRANSMIT A REPORT OF THE RESULTS OF THIS STUDY TO YOU AT THIS TIME.

IN SUMMARY, THE COSTS OF FRACTURE ARE LARGE. IN 1982 DOLLARS THE TOTAL COST WAS ESTIMATED TO BE $119 BILLION PER YEAR, ABOUT FOUR PERCENT OF THE GROSS NATIONAL PRODUCT. AN ESTIMATED $35 BILLION PER YEAR COULD BE SAVED THROUGH THE USE OF CURRENTLY AVAILABLE TECHNOLOGY. COSTS COULD BE FURTHER REDUCED BY AS MUCH AS $28 BILLION PER YEAR THROUGH FRACTURE RELATED RESEARCH.

THE STUDY CONCLUDED THAT SUBSTANTIAL MATERIAL, TRANSPORTATION, AND CAPITAL INVESTMENT COSTS COULD BE SAVED IF TECHNOLOGY TRANSFER, COMBINED WITH RESEARCH AND DEVELOPMENT, SUCCEEDED IN REDUCING THE FACTORS OF UNCERTAINTY RELATED TO STRUCTURAL DESIGN. EQUALLY SAFE OR SAFER STRUCTURES COULD BE PRODUCED WITH SUBSTANTIAL COST SAVINGS IN

MATERIAL, TRANSPORTATION, AND CAPITAL INVESTMENT. THIS COULD BE DONE BY REDUCING THE UNCERTAINTY CURRENTLY RELATED TO STRUCTURAL DESIGN THROUGH BETTER PREDICTIONS OF STRUCTURAL PERFORMANCE FROM MATERIALS PROPERTIES, BETTER PROCESS AND QUALITY CONTROL AND IN-SERVICE FLAW MONITORING, AND LESS MATERIALS VARIABILITY.

WE BELIEVE THAT THIS IS THE MOST RELIABLE AND COMPREHENSIVE STUDY OF THE COSTS OF FRACTURE AND SHOULD THEREFORE BE ESPECIALLY VALUABLE IN MAKING INFORMED POLICY DECISIONS.

CONGRESSIONAL FLOORS

CONGRESSIONAL "FLOOR" EXPENDITURE REQUIREMENTS ARE OF PARTICULAR CONCERN TO US BECAUSE THEY COULD FORCE REDIRECTION OF RESOURCES FROM CORE PROGRAMS INTO PROGRAMS OF SPECIAL INTEREST, AND COULD CAUSE MAJOR PROGRAM DISRUPTIONS. REPROGRAMMING EFFORTS RESULTING FROM THE USE OF CONGRESSIONAL "FLOORS" WOULD IMPOSE SERIOUS MANAGEMENT PROBLEMS AND POSSIBLE RIF'S.

DURING THE PAST YEAR, WE CONTINUED OUR RESEARCH IN SUPPORT OF THE HANDICAPPED AND ARE CONTINUING TO DO SO IN ORDER TO MEET THE $1 MILLION FLOOR IN OUR FISCAL YEAR 1983 BUDGET. WE RECENTLY COMPLETED A REPORT DESCRIBING OUR ACTIVITIES AND I WILL BRIEFLY SUMMARIZE THEM. NBS' FIRE SAFETY EVALUATION SYSTEM, DEVELOPED IN PRIOR YEARS FOR HEALTH CARE FACILITIES, WAS EXPANDED TO COVER COMMUNITY-BASED RESIDENTIAL FACILITIES. THE NATIONAL FIRE PROTECTION ASSOCIATION IS NOW CONSIDERING ADOPTING THIS MODIFICATION IN THE LIFE SAFETY CODE. IN

ADDITION, WE ARE GIVING GRANTS TO UNIVERSITIES FOR WORK ON MEDICAL TREATMENT TO REDUCE OR PREVENT PERMANENT DISABLING EFFECTS OF CARBON MONOXIDE INTOXICATION. WE ARE CONDUCTING RESEARCH ON THE PROPERTIES OF A NUMBER OF ALLOYS FOR USE IN METALLIC SURGICAL IMPLANTS. WE ARE INVESTIGATING TEST METHODS FOR POLYMERIC IMPLANT MATERIALS AND MEASURING THE WEAR AND FRACTURE RESISTANCE OF POLYETHYLENE HIP IMPLANTS UNDER A VARIETY OF STATIC AND FATIGUE LOADING CONDITIONS.

WE ARE CONDUCTING RESEARCH ON ADVANCED METALS PROCESSING IN RESPONSE TO THE INTEREST EXPRESSED BY THIS COMMITTEE. AS DESCRIBED EARLIER THE WORK IS PRIMARILY FOR THE PRODUCTION OF DATA FOR BINARY PHASE DIAGRAMS, AND HAS BEEN COMPLIMENTED WITH CONSIDERABLE SUPPORT FROM THE METALS INDUSTRY.

WE ARE CONDUCTING RESEARCH IN OUR AUTOMATED MANUFACTURING RESEARCH PROGRAM TO MEET THE $3.2 MILLION FLOOR IN ROBOTICS. WE HAVE COMPLETED THE FIRST MANUFACTURING CELL WITH ROBOT CART, ROBOT, AND VERTICAL MILLING MACHINE WITH ONE MORE CELL TO BE COMPLETED WITHIN THE NEXT FOUR MONTHS. WE ARE COMPLETING THE INSTALLATION OF THE NBS CONTROL ARCHITECTURE FOR ROBOTS ON A MICROCOMPUTER NETWORK AND ARE ALSO CONDUCTING COMPUTER SIMULATION EXPERIMENTS OF A MANUFACTURING CELL IN ORDER TO DESIGN APPROPRIATE CELL INTERFACES. WE EXPECT TO COMPLETE WORK ON A ROBOT VISION SYSTEM WHICH EMPLOYS STRUCTURED LIGHT VISION TECHNIQUES TO DEFINE THE POSITION AND ORIENTATION OF ANY OBJECT RELATIVE TO A ROBOT GRIPPER.

We are working in four functional areas to meet the $10 million floor for Computer Sciences and Technology: (1) Connectivity of components, systems, and networks. This work is designed to improve user capabilities to acquire compatible, off-the-shelf computer products and services and to maintain the capability of U.S. industry to compete in world markets. (2) Management and use of computers throughout the system life cycle. Programs in this area help users to manage and apply information technology effectively throughout the system life cycle and to improve organizational productivity. (3) Integrity and reliability of computer systems. The goal of these programs is to help users improve the integrity, reliability, and availability of systems. (4) Administration. This includes activities and reports supporting all program areas to improve technical exchange.

Overhead Activities

Last year the Committee expressed an interest in receiving more information regarding our overhead activities. Included in our budget justification, beginning on page 104, are details on the cost and descriptions of these activities. This portion of our costs receives a good deal of my personal attention to assure that they do not detract from funds available for our technical programs. Over the last five years, staff assigned to overhead activities has been reduced 17 percent. The cost of services provided to NBS such as utilities, postage, and telephones has risen a dramatic 61.5 percent during the same period. While maintaining the efficiency of service

TO THE TECHNICAL PROGRAMS, WE HAVE BEEN ABLE TO HOLD THE TOTAL COST OF OVERHEAD TO NO HIGHER THAN 25 PERCENT OF OUR TOTAL OPERATING EXPENSES. THIS COMPARES VERY FAVORABLY WITH OVERHEAD RATES FOR SIMILAR PUBLIC AND PRIVATE LABORATORIES. WHILE REDUCTIONS HAVE BEEN NECESSARY, WE HAVE BEEN ABLE TO MAINTAIN THE QUALITY AND INCREASE THE EFFICIENCY OF CRITICAL SUPPORT SERVICES AT NBS.

IN CONCLUSION, I LOOK FORWARD TO WORKING WITH THIS SUBCOMMITTEE IN THE FUTURE. I WILL BE PLEASED TO ANSWER ANY QUESTIONS YOU MAY HAVE.

Mr. REID. Dr. Ambler, what we will do is allow the rest of the witnesses to finish their testimony and then we will allow the committee to ask questions.

The next witness, I understand, is Dr. John Lyons. Dr. Lyons is the Director of the National Engineering Laboratory. We have asked him to bring several short films on the work of the National Engineering Laboratory, in order to give the subcommittee better insight into two of the important areas of research and development at the National Bureau of Standards—building research work and the robotics research and development effort.

Dr. Lyons.

Dr. LYONS. Thank you, Mr. Chairman.

Let me first read a very brief summary of my statement and then I'll show the video tapes, if I may. I have a long, detailed statement on the programs I shall submit for the record, with your permission.

Mr. REID. We will make that part of the record.

Dr. LYONS. Thank you.

[A biographical sketch of Dr. Lyons follows:]

JOHN W. LYONS

Date of Birth: November 5, 1930

Birthplace: Reading, Massachusetts

Education: Degrees

Harvard University, A.B., Chemistry
1952
Washington University, A.M., Physical Chemistry
1963
Washington University, Ph.D., Physical Chemistry
1964

Position:

Director
National Engineering Laboratory
National Bureau of Standards

As Director of the National Engineering Laboratory Dr. Lyons is responsible for NBS's research in applied mathematics, building technology, electronics and electrical engineering, energy conservation, engineering standards development, fire, manufacturing engineering and chemical engineering.

Dr. Lyons was Director of the NBS Center for Fire Research until December 18, 1977, and was responsible for providing scientific and technical knowledge applicable to the prevention and control of fires.

Dr. Lyons served in various research and development positions at the Monsanto Company from 1955 to 1973. He specialized in the chemistry and uses of phosphorus-based chemicals including fire retardants. He served from 1971 to 1973 as a member of the ad hoc panel of fire research, a National Academy of Sciences evaluation panel for the National Bureau of Standards.

Dr. Lyons is author of two books: Viscosity and Flow Measurement and The Chemistry and Uses of Fire Retardants. He has contributed chapters to five other books and has written numerous papers and articles on technical or research topics. His early research interest was the physical chemistry of polyelectrolyte solutions, especially formation of complexes with metal ions. This work emphasized the behavior of inorganic polyphosphates and desoxy ribonucleic acid (DNA).

Dr. Lyons is a Fellow of the American Association for the Advancement of Science, Fellow of the Washington Academy of Science, member of the American Chemical Society (past chairman of the St. Louis Section), member of the American Institute of Chemical Engineers, and member of Sigma Xi. He serves on the Advisory Committee for Engineering, National Science Foundation; Advisory Council, College of Engineering, University of Maryland; Board of Directors, National Fire Protection Association. He is serving on a special committee of the Maryland State Board for Higher Education to study the needs for engineering education. He was chairman of the Products Research Committee (1974-1979), a nine-member charitable trust administering a $5M research fund on fire research; co-chairman of the US-Japan Natural Resources Panel of Fire Research (1975-1978). He received the Presidential Management Improvement Award in 1977 and the U.S. Department of Commerce Gold Medal. also in 1977. In 1981 he received the Presidential Rank Award of Distinguish Executive.

STATEMENT OF DR. JOHN W. LYONS, DIRECTOR, NATIONAL ENGINEERING LABORATORY, NATIONAL BUREAU OF STANDARDS

Dr. LYONS. I am pleased to be here to talk about the Engineering Laboratory and to show the film that you requested.

Let me just quickly summarize the budget situation with regard to the National Engineering Laboratory. Under the subactivity engineering measurements and standards, in fiscal year 1983, there were $21,682,000 and 370 positions; in fiscal year 1984, that same subactivity is $18,507,000 and 312 positions. Most of the reduction is from the proposal to terminate the building research program and to closedown the Center for Building Technology.

Under the budget subactivity core measurement research for new technologies, under automated manufacturing research, which encompasses interface standards, mechanical engineering metrology, and the automated manufacturing research facility, in fiscal year 1982, we had $6,094,000, 104 positions. This rose in fiscal year 1983 to $7,430,000 and 114 positions. In the budget for fiscal year 1984, it will be reduced to $6,218,000 and back to 104 positions. That's a net reduction, then, of $1,212,000 and 10 positions.

Under the subactivity labeled fire research, in fiscal year 1983, there are $5,886,000 and 40 positions; in fiscal year 1984, there are shown zero dollars and positions.

The budget proposes elimination of the Center for Fire Research and its programs.

That concludes my statement. With your permission, I'll now show the film that you requested.

On Valentine's Day, this year, 3 days after the great blizzard of 1983, members of the subcommittee, Chairman Walgren and Congressman Reid visited the Bureau of Standards, braving the snows, brought a number of staff with them, and visited the building research program, the automation program and the fire research program.

Here, we are shown in the large structures laboratory of CBT, looking at large test equipment, this one for earthquake—seismic—resistance.

I'm showing you the test setup that we used in investigating the Hyatt Regency collapse that occurred in Kansas City. That's the test rig itself.

Then we showed you the video tape from NBC news that I am now going to run.

[Witness showing film.]

Dr. LYONS. We moved from building research to the automation research facility and we demonstrated our work station with the horizontal mill.

In this program, we are working on quality assurance, measurement science for the unmanned factory of the future and on software interface standards for the machine tools.

Here, you are seeing a tape of the actual demonstration that we conducted for our visitors. The robot cart delivers the work stock piece to the robot.

This is a large Cincinnati T-3 robot which now picks up the stock, or workpiece, and presents it for automatic fixturing to the machine tool.

All of this is being done under a hierarchy of computers and, of course, one of the things we are trying to demonstrate is that the microprocessors coming from different manufacturers can, in fact, talk to each other through our proposed nonproprietary interfaces.

The workpiece has been locked into place and now the horizontal mill will do the actual cutting on the part. This is the part of the machining operation that's productive. All of the rest of it is getting ready.

The automated manufacturing research facility is our principal test bed for our entire automation program.

We went on from this facility to visit the fire research laboratory at the other end of the campus and we showed a number of things there. I have a video tape of that which I showed to the subcommittee last Wednesday.

This completes my statement, Mr. Chairman.

[The prepared statement of Dr. Lyons follows:]

U.S. DEPARTMENT OF COMMERCE

STATEMENT OF
JOHN W. LYONS, DIRECTOR
NATIONAL ENGINEERING LABORATORY
NATIONAL BUREAU OF STANDARDS

BEFORE THE

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
ON AUTHORIZATION OF APPROPRIATIONS FOR FISCAL YEAR 1984

MARCH 22, 1983

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE: IT IS A PLEASURE FOR ME TO APPEAR BEFORE THIS SUBCOMMITTEE TO DISCUSS THE PROGRAMS OF THE NATIONAL ENGINEERING LABORATORY OF THE NATIONAL BUREAU OF STANDARDS.

INTRODUCTION

THE NATIONAL ENGINEERING LABORATORY (NEL) PROVIDES TO USERS IN INDUSTRY, OTHER GOVERNMENT AGENCIES, AND TO THE SCIENTIFIC AND ENGINEERING COMMUNITIES THE FOLLOWING SERVICES AND ASSISTANCE: ENGINEERING DATA; MEASUREMENT PROCEDURES; CALIBRATION SERVICES AND SPECIAL TESTS; TEST METHODS; AND THE RESULTS OF RESEARCH IN ENGINEERING AND SCIENTIFIC FIELDS IN SUPPORT OF THESE EFFORTS. OUR PROGRAMS ARE DESIGNED TO ADDRESS MAJOR NATIONAL PROBLEMS WITHIN THE POLICY FRAMEWORK PROVIDED BY THE ADMINISTRATION AND CONGRESS. WE WORK ON THE TECHNICAL ASPECTS OF THESE PROBLEMS AND CONCENTRATE ON THOSE AREAS WHERE THE PRIVATE SECTOR CANNOT MOUNT AN APPROPRIATE EFFORT AND WHERE THE INDEPENDENCE AND OBJECTIVITY OF NBS IS ESSENTIAL. IN FY83 WE ARE CARRYING OUT THE FOLLOWING ACTIVITIES AND PROGRAMS: BUILDING RESEARCH, SIGNALS AND SYSTEMS METROLOGY, CHEMICAL ENGINEERING METROLOGY, MATHEMATICAL SCIENCES, SEMICONDUCTOR PROGRAM, AUTOMATED MANUFACTURING, FIRE RESEARCH, AND TECHNICAL REIMBURSABLE SERVICES.

I WOULD NOW LIKE TO DESCRIBE THE MAJOR PROGRAMS AND HIGHLIGHT SOME RECENT ACCOMPLISHMENTS.

ENGINEERING MEASUREMENT AND STANDARDS SUBACTIVITY

THIS PART OF THE NBS BUDGET INCLUDES NEL'S BUILDING RESEARCH, SIGNALS AND SYSTEMS METROLOGY, CHEMICAL ENGINEERING METROLOGY, MATHEMATICAL SCIENCES, AND TECHNICAL REIMBURSABLE SERVICES. THE SUBACTIVITY WAS FUNDED IN FY1982 AND FY1983 AT $20,156K (374 POSITIONS) AND $21,682K (370 POSITIONS) RESPECTIVELY. IN FY1984 THE BUDGET WILL BE REDUCED TO $18,507K (312 POSITIONS). THE REDUCTION IS PRIMARILY DUE TO THE ELIMINATION OF THE BUILDING RESEARCH PROGRAM.

BUILDING RESEARCH

THE FY 1984 BUDGET PROPOSES TO TERMINATE THIS PROGRAM WITH A BUDGET REDUCTION OF $3,174K (41 POSITIONS). IN FY82 AND FY83 OTHER AGENCIES SUPPORTED ADDITIONAL BUILDING RESEARCH ACTIVITIES AT A LEVEL OF ABOUT $8.0 MILLION. THIS WORK WILL BE TERMINATED IN FY 1984 AND THE CENTER FOR BUILDING TECHNOLOGY WILL BE CLOSED DOWN DURING THE YEAR. THIS DECREASE SUPPORTS THE ADMINISTRATION'S POSITION THAT THE PRIVATE SECTOR AND STATE AND LOCAL GOVERNMENTS SHOULD TAKE A GREATER ROLE IN SUPPORTING THESE PROGRAMS. WITH PROPER SUPPORT FROM THE CONSTRUCTION INDUSTRY, COMPETENT RESEARCH EFFORTS CAN CONTINUE.

The Center for Building Technology performs work on structural engineering, building materials characterization, and measurements on building systems and equipment. Current topics under study include mechanisms of structural failure, improved test methods for inclusion in building code provisions, improvements in the means of measuring and predicting setting of portland cement concrete, performance measures on building lighting, acoustics, ventilation and thermal energy circulation, and proposed measurement standards for building equipment such as air conditioners, heat pumps, and various active and passive solar energy systems. The Center has traditionally performed a substantial fraction of its work for other Federal agencies and counts among its current clients the General Services Administration, the Department of Housing and Urban Development, the Department of Energy, the Department of Transportation, the Department of the Interior, the National Science Foundation, the Federal Trade Commission, the Occupational Safety and Health Administration, the Federal Emergency Management Agency (FEMA), and the White House.

The Center has responsibility for the development of seismic design and construction provisions for the National Earthquake Hazard Reduction Program; we work closely with the Federal Emergency Management Agency, U. S. Geological Survey, and the National Science Foundation in this effort. We have been requested by the lead agency, FEMA, to chair the Interagency Committee on Seismic Safety in Construction. In this activity we have focused on four areas: buildings, lifelines, site hazards, and practices for grant, lease and regulatory programs. We have also completed for the Building Seismic Safety Council plans for their program of trial designs of representative buildings

NATIONWIDE TO PROVIDE A BASIS FOR THE COUNCIL TO RECOMMEND NATIONALLY APPLICABLE SEISMIC DESIGN AND CONSTRUCTION PROVISIONS.

RECENT ACCOMPLISHMENTS BY THE NBS BUILDING RESEARCH PROGRAM INCLUDE THE FOLLOWING:

- BASIC RESEARCH ON THE CHEMISTRY AND PHYSICS OF MODEL COMPOUNDS REPRESENTING PORTLAND CEMENT IS SHOWING THE DETAILS OF HOW DRY CEMENT REACTS WITH WATER TO FORM THE PRODUCT WHICH HOLDS CONCRETE TOGETHER. THIS UNDERSTANDING WILL ENABLE US TO PREDICT EFFECTS OF CONSTITUENTS AND ADMIXTURES ON CONCRETE STRENGTH AND DURABILITY AND TO DESIGN MEASURING SENSORS AND PREDICTIVE RELATIONS GOVERNING THE DECISION AS TO WHEN FORMS MAY SAFELY BE STRIPPED FROM NEW CONCRETE. THIS IS A MAJOR ISSUE IN CONTROLLING CONSTRUCTION SAFETY AND COST.

- WE PROVIDED THE SECRETARIAT FOR ANSI'S A58 COMMITTEE IN DEVELOPING A NEW VERSION OF THE STANDARD "MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES." THIS STANDARD INCORPORATES MUCH OF OUR RECENT WORK ON LIVE, WIND, AND EARTHQUAKE LOADS AND USES NEW CRITERIA BASED ON PROBABILITY ANALYSIS THAT WE EXPECT WILL IMPROVE RELIABILITY OF STRUCTURES BUILT UNDER THE STANDARD AND REDUCE DESIGN COSTS.

- WE HAVE CONSTRUCTED A UNIQUE DISPLACEMENT- AND FORCE-CONTROLLED, TRIPLE-DIMENSIONAL LOAD TEST FACILITY WHICH WILL SIMULATE EARTHQUAKE SHOCKS ON STRUCTURES OF MODEST SIZE AT FULL SCALE. WITH THIS EQUIPMENT, WE ARE DEVELOPING THE BASIS FOR SPECIFYING THE REQUIRED RESISTANCE OF MASONRY WALLS IN SEISMICALLY ACTIVE REGIONS.

o We completed, for the Occupational Safety and Health Administration, a detailed study of the collapse of the interchange under construction at Riley Road in East Chicago, Indiana. The collapse occurred on April 15, 1982, killing 13 construction workers. The Center found there were four factors which contributed to the failure and that it took all four to produce collapse. A number of changes in practice have been recommended as a result of the study. This is the latest in a series of such investigations undertaken by the Center for Building Technology in recent years.

Signals and Systems Metrology

In FY 1982 and FY 1983 this program was funded at $5,287K (108 positions) and $5,591K (107 positions) respectively. The FY 1984 budget continues this program at $5,961K (107 positions). Reimbursable support for the program in FY 1983 and FY 1984 is planned at about $7.5 million, including calibration fees.

In our Signals and Systems Metrology program we provide three kinds of technical services; namely, calibration and measurement assurance related to national standards, measurement methods and related technology in critical problem areas, and the underlying fundamental research necessary to conduct these projects.

In the calibration and measurement sector, high speed and digital signal processing techniques continue to create demands for NBS services. Technical

TRENDS INCLUDE MORE USE OF DIGITAL SIGNAL PROCESSING, OPTICAL FIBER TRANSMISSION, AND HIGHER DATA TRANSMISSION RATES. THESE TRENDS ARE DRIVEN BY SEVERAL DEVELOPMENTS, THE MOST SIGNIFICANT OF WHICH IS THE ADVENT OF THE LOW-COST MICROPROCESSOR ON A CHIP. THE TECHNOLOGY MOVES VERY QUICKLY IN ELECTRONICS AND COMMUNICATIONS. I SHALL MENTION SOME DEVELOPMENTS WHICH GIVE A PERSPECTIVE ON THE NATURE OF OUR WORK.

- AT THE REQUEST OF THE GENERAL ASSEMBLY OF THE UNION RADIO SCIENTIFIQUE INTERNATIONALE (URSI) AND THE HIGH-FREQUENCY WORKING GROUP OF THE CONSULTATIVE COMMITTEE ON ELECTRICITY OF THE INTERNATIONAL CONFERENCE OF WEIGHTS AND MEASURES, NBS RECENTLY COMPLETED THE COORDINATION OF AN INTERCOMPARISON OF THE MEASUREMENT CAPABILITY FOR ELECTRIC FIELD STRENGTH AT 100 MHz. PARTICIPANTS BESIDES NBS INCLUDED THE FERNMELDETECHNISCHES ZENTRALAMT (FTZ), FEDERAL REPUBLIC OF GERMANY; INSTITUTO ELETTROTECNICO NAZIONALE (IEN), ITALY; AND TECHNICAL UNIVERSITY OF WROCLAW (TUW), POLAND. THE RESULTS FOR EACH LABORATORY WERE WELL WITHIN THEIR ESTIMATED UNCERTAINTY.

- NBS HAS DEVELOPED A HIGHLY SENSITIVE ELECTRO-OPTICAL LINK FOR USE IN MAKING MEASUREMENTS IN THE NEAR-FIELD REGION OF ANTENNAS. THE LINK REPLACES CONVENTIONAL METALLIC CABLES WHICH CAN ACT AS ANTENNAS THEMSELVES AND CAN INTERFERE WITH ELECTROMAGNETIC FIELD MEASUREMENTS MADE NEAR THE ANTENNA.

- A NEW JOSEPHSON-JUNCTION COUNTER DESIGNED TO OPERATE AT 100 GHz HAS BEEN BUILT AND TESTED. INDIRECT TESTING AND COMPUTER SIMULATIONS INDICATE PROPER OPERATION TO MORE THAN 100 GHz, THE FASTEST RATE EVER ACHIEVED BY A

COUNTER AND PERHAPS THE FASTEST DIGITAL CIRCUIT EVER DEVISED. THIS IMPROVES OUR ABILITY TO MAKE THE VERY FAST MEASUREMENTS THAT WILL BE NEEDED IN THE NEAR FUTURE.

- MANUFACTURERS OF AUTOMATED TEST EQUIPMENT, ATE, ARE BEGINNING TO INCLUDE A SPECIAL MODULE WHICH CAN BE TAKEN OUT AND SENT TO NBS TO BE CALIBRATED BY THE NEW NBS CALIBRATION PROCEDURE FOR ANALOG-TO-DIGITAL SIGNAL CONVERSION. THIS CALIBRATED MODULE, IN TURN, IS USED IN THE CALIBRATION OF ATE.

IN THE NEXT TWO YEARS WE EXPECT TO LAY DOWN THE TECHNICAL BASIS FOR MEASUREMENT ASSURANCE IN COMPLEX AUTOMATED TEST EQUIPMENT, BEGINNING WITH A FUNDAMENTAL STUDY OF ERROR PROPAGATION THROUGH THE TORTUOUS SIGNAL PATHS IN THESE DEVICES. WE PLAN MORE WORK ON INTEGRATED OPTOELECTRONIC SYSTEMS. WE ARE NOW STUDYING FAST SIGNAL DETECTION USING AN OPTICAL FIBER TRANSMISSION LINE AND AN INTEGRATED OPTICAL SIGNAL DETECTOR AND A JOSEPHSON-JUNCTION SIGNAL PROCESSOR.

CHEMICAL ENGINEERING METROLOGY

IN FY 1982 AND FY 1983 THIS PROGRAM WAS FUNDED AT $3,407K (63 POSITIONS) AND $3,642K (62 POSITIONS) RESPECTIVELY. THE FY 1984 BUDGET CONTINUES THIS PROGRAM AT $3,971K (66 POSITIONS). REIMBURSABLE SUPPORT FOR THE PROGRAM IN FY 1983 AND FY 1984 IS EXPECTED TO BE NEARLY $5 MILLION.

THIS PROGRAM PROVIDES MEASUREMENT SERVICES, DATA, AND FUNDAMENTAL INFORMATION ON HEAT AND MASS TRANSFER TO THE CHEMICAL AND PETROCHEMICAL INDUSTRIES. WE

DEVELOP NEW MEASUREMENT METHODS, CALIBRATE INSTRUMENTS, MEASURE PROPERTIES OF COMPOUNDS AND MIXTURES OF COMPOUNDS, AND PROVIDE PREDICTIVE ENGINEERING RELATIONSHIPS USEFUL IN THE DESIGN AND CONTROL OF CHEMICAL PROCESSES AND TO INSURE EQUITY IN DOMESTIC AND INTERNATIONAL TRADE. WE CONDUCT A SIGNIFICANT BASIC RESEARCH PROGRAM - BOTH THEORETICAL AND EXPERIMENTAL - IN SUPPORT OF THESE TECHNICAL SERVICES. DURING THE PAST YEAR WE PASSED A NUMBER OF MILESTONES.

o AN NBS-SPONSORED CONFERENCE ON THE MULTIDISCIPLINARY TOPIC OF NONLINEAR BEHAVIOR IN FLUIDS WAS HELD ON JUNE 6-11, 1982. THE CONFERENCE INCLUDED 100 INVITED PARTICIPANTS FROM AROUND THE WORLD. PARTICIPANTS INCLUDED SOME OF THE WORLD'S LEADING AUTHORITIES IN STATISTICAL MECHANICS, KINETIC THEORY, AND OTHER RELATED FIELDS. THE PURPOSE OF THE CONFERENCE WAS TO DISCUSS RECENT RESULTS OBTAINED FOR FLUIDS IN NONEQUILIBRIUM.

o WE ANNOUNCED A NEW THERMOMETER BASED ON AN OPTICAL FIBER (SINGLE CRYSTAL SAPPHIRE) TRANSMISSION LINE AND USING THE BASIC PRINCIPLES OF THE BLACK-BODY RADIATION LAWS. THIS THERMOMETER IS PARTICULARLY USEFUL IN HARSH ENVIRONMENTS OVER THE RANGE OF 600 - 2,000°C, IS ACCURATE TO ±0.05%, AND HAS A VERY FAST RESPONSE TIME. THIS SENSOR NOT ONLY MAY BECOME THE BASIS FOR A NEW INTERNATIONAL STANDARD OVER THIS TEMPERATURE RANGE BUT ALSO HAS MANY ENGINEERING APPLICATIONS.

o WE DEVELOPED A SOFTWARE PACKAGE FOR PREDICTING THERMOPHYSICAL PROPERTIES AND TRANSPORT COEFFICIENTS FOR CHEMICAL MIXTURES. THE EXTENSION ENABLES US TO PREDICT PROPERTIES IN TWO COEXISTING PHASES, E.G., LIQUID AND VAPOR. THIS PACKAGE IS AN EXTENSION OF LAST YEAR'S TRANSPORT PROPERTIES

PREDICTION PROGRAM, TRAPP, AND WILL BE MADE AVAILABLE TO THE SAME DESIGN ENGINEERING COMMUNITY.

- WE PUBLISHED AN IMPROVED THEORETICAL TREATMENT OF THE MOVEMENT OF IONS IN SOLUTION. WE EXPECT TO PUT THIS UNDERSTANDING TO GOOD USE IN DEVELOPING PREDICTIVE RELATIONS FOR SEPARATIONS IN WHICH CHARGED SPECIES MOVE THROUGH POROUS BARRIERS (OR IN AN ALTERNATIVE DESIGN ARE PREVENTED FROM PASSING THROUGH SUCH BARRIERS).

- WE HAVE A NEW FLOW METER WHICH WILL MEASURE VOLUME FLOW RATE OF GASES IN A PIPE ON AN ABSOLUTE BASIS. THE MEASUREMENTS, BASED ON PROPAGATION OF ACOUSTIC WAVES, ARE NOT AFFECTED BY VARIATIONS IN FLOW, TEMPERATURE, OR DENSITY PROFILES ACROSS THE PIPE. WE EXPECT WIDE APPLICATION.

- DATA HAVE BEEN TAKEN ON LIQUID ISOBUTANE AT HIGH PRESSURES USING A NEW MAGNETIC SUSPENSION DENSIMETER. THE DATA WILL BE USEFUL IN PROCESS DESIGN; THE TECHNIQUE WILL BE APPLICABLE TO A BROAD RANGE OF SUBSTANCES.

WE HAVE LAID THE BASIS FOR OUR PROGRAM ON FLOW MEASUREMENT AND PREDICTION IN MULTI-PHASE SYSTEMS (COAL IN OIL, COAL IN AIR, PAPER PULP IN WATER, ETC.) BY CONSTRUCTING A RESEARCH FACILITY AND CARRYING OUT EXPLORATORY STUDIES USING NON-INTRUSIVE MEASUREMENT TECHNIQUES. THERE IS RELATIVELY LITTLE OF A FUNDAMENTAL NATURE KNOWN ABOUT FLOW IN MULTIPHASE SYSTEMS. WE PLAN TO PROVIDE BASIC INFORMATION AS WELL AS MEASUREMENT AND PREDICTION TECHNIQUES FOR CUSTODY TRANSFER AND CLOSER PROCESS CONTROL IN THE DESIGN AND OPERATION OF PIPING, PUMPING, AND HOLDING TANKS FOR SUCH SYSTEMS. THIS INFORMATION WILL REDUCE OVERDESIGN AND COST OF HARDWARE AND IMPROVE OPERATING CHARACTERISTICS.

MATHEMATICAL SCIENCES

IN FY 1982 AND FY 1983 THIS PROGRAM WAS FUNDED AT $4,730K (88 POSITIONS) AND $5,013K (87 POSITIONS) RESPECTIVELY. THE FY 1984 BUDGET CONTINUES THIS PROGRAM AT $5,503K (94 POSITIONS). REIMBURSABLE SUPPORT FOR THE PROGRAM IN FY 1983 AND FY 1984 IS PLANNED AT ALMOST $1 MILLION.

THE MATHEMATICAL SCIENCES PROGRAM PROVIDES SUPPORT IN MATHEMATICAL MODELING, STATISTICS, DATA ANALYSIS AND COMPUTING TO ALL THE ENGINEERING AND SCIENTIFIC PROGRAMS OF ALL NBS AND TO SOME CLIENTS IN OTHER FEDERAL AGENCIES. THE CENTER FOR APPLIED MATHEMATICS, CAM, CONDUCTS WORK IN NUMERICAL ANALYSIS, STATISTICAL ENGINEERING, OPERATIONS RESEARCH, AND SOFTWARE FOR SCIENTIFIC COMPUTING AND ENGAGES IN EXTENSIVE COLLABORATION WITH THE NBS SCIENTIFIC STAFF. THE CENTER ALSO PROVIDES TECHNICAL ASSISTANCE WITH LABORATORY AUTOMATION, OPERATES THE NBS NET (WHICH LINKS COMPUTERS, WORD PROCESSORS, AND TERMINALS THROUGHOUT NBS) AND OPERATES THE CENTRAL COMPUTER.

ACCOMPLISHMENTS OVER THE PAST YEAR INCLUDE THE FOLLOWING ITEMS:

- A SIGNIFICANT ENHANCEMENT TO A DATA ANALYSIS PROGRAM HAS BEEN MADE. IT IS AN INTERACTIVE SCREEN DATA EDITING PROGRAM CALLED DATED. THE DATED PROGRAM CAN ADD OR DELETE POINTS OR POLYGONAL REGIONS OF DATA, ZOOM, ROTATE OR TRANSLATE BASED ON CURSOR COMMANDS. THIS PROGRAM WILL PERFORM AN IMPORTANT PRE-PROCESSOR FUNCTION FOR EXPERIMENTAL DATA BEFORE BEING PROCESSED BY MORE SOPHISTICATED DATA FITTING PROGRAMS.

- A VECTOR ALGORITHM WAS DEVELOPED, CODED, AND TESTED ON A POWERFUL SCIENTIFIC COMPUTER. TIMING TESTS INDICATED THAT THIS ALGORITHM IS VERY FAST. IN MANY OF NBS'S PROGRAMS THREE-DIMENSIONAL MODELS ARE BEING DEVELOPED. THE COMPUTATIONAL EXPENSE ASSOCIATED WITH THE USE OF THESE MODELS WILL BE VERY LARGE UNLESS WE HAVE FAST ALGORITHMS.

- THE CENTER HAS ACQUIRED A FIRST-CLASS COMPUTER GRAPHICS SYSTEM AND HAS DEVELOPED AND ACQUIRED THE NECESSARY SOFTWARE FOR ITS USE. WE HAVE USED THE SYSTEM TO DISPLAY DATA FROM THE ROOM FIRE MODEL, TERNARY ALLOY PHASE DIAGRAMS, AND MOLECULAR DENSITY MAPS. A WELL-DESIGNED GRAPHICS SYSTEM PERMITS THE UTILIZATION OF THE SCIENTIST'S OR ENGINEER'S INTUITION IN ANALYZING A COMPLEX PROBLEM ON THE COMPUTER. INTERACTIVE GRAPHICS SYSTEMS ARE BECOMING AN IMPORTANT COMPONENT OF SCIENTIFIC COMPUTING, INDEED OF MOST ENGINEERING RESEARCH.

- THE CENTER COMPLETED STUDIES WITH THE TIME AND FREQUENCY DIVISION AND REPORTED AN IMPROVED STATISTICAL PROCEDURE FOR COMBINING DATA FOR AN ENSEMBLE OF ATOMIC CLOCKS TO FORM A PRIMARY ATOMIC TIME SCALE KNOWN AS TA(NBS). USING A PROCEDURE KNOWN AS KALMAN RECURSION WE ARE ABLE TO ADD OR REMOVE INDIVIDUAL CLOCKS AT ANY TIME DEPENDING ON TRENDS DETECTED BY THE TECHNIQUE. WE CAN THUS PROVIDE IMPROVED ESTIMATES OF TIME.

IN THE NEXT TWO YEARS THE CENTER WILL CONTINUE TO CONCENTRATE ON THE SAME GENERAL AREAS OF MATHEMATICS AND COMPUTING. MORE EFFICIENT SOFTWARE FOR ALL MATHEMATICAL COMPUTATION WILL BE REQUIRED; THE CENTER WILL CONTINUE TO PLAY THE LEAD ROLE IN ACQUIRING AND ADOPTING THESE SOFTWARE PACKAGES FOR NBS USE. MICROPROCESSORS WILL BE EVERYWHERE; NBS STAFF WILL NEED THE CENTER'S HELP IN

USING THESE COMPUTERS EFFECTIVELY. THE CENTER'S TRAINING OR EDUCATIONAL ROLE WILL BECOME EVEN MORE IMPORTANT.

IN ADDITION TO MAKING THE ABOVE CONTRIBUTION TO THE MATHEMATICAL SCIENCES PROGRAM, CAM HAS ALSO BEEN HEAVILY INVOLVED WITH THE ACQUISITION OF ADEQUATE COMPUTING CAPABILITIES FOR NBS. RECENT ACCOMPLISHMENTS INCLUDE:

- THE CENTRAL COMPUTER WAS REPLACED WITH A NEWER (INTERIM) MACHINE WITH AN INCREASE IN COMPUTING CAPABILITIES OF ABOUT A FACTOR OF THREE. THIS TRANSITION WAS COMPLETED BY LATE SPRING 1982. THE MACHINE IS OPERATING SMOOTHLY AND IS MEETING THE LIMITED REQUIREMENTS SET FOR IT. IT IS AN INTERIM SOLUTION TO THE NBS COMPUTING PROBLEM.

- THE NBS COMPUTER PLANNING AND RESOURCE GROUPS WORKED CLOSELY WITH GAO AND DOC STUDY TEAMS TO DEFINE THE LONG-TERM COMPUTING NEEDS OF NBS AND THE OPTIMUM RESPONSE. AS DESCRIBED EARLIER BY DR. AMBLER, DOC PLANNING FOR THE ACQUISITION OF A POWERFUL COMPUTER HAS BEGUN.

UPGRADING THE CENTRAL COMPUTATIONAL FACILITY AND THE NBS NET WILL REQUIRE CONSIDERABLE ATTENTION DURING THE NEXT TWO YEARS.

TECHNICAL REIMBURSABLE SERVICES

THIS PROGRAM IS TOTALLY SUPPORTED ON A REIMBURSABLE BASIS AND INCLUDES FUNDING FOR THE NBS OFFICE OF ENERGY RELATED INVENTIONS (OERI) AND THE NBS LAW ENFORCEMENT STANDARDS LABORATORY (LESL). THE PROGRAM OPERATES AT A LEVEL OF BETWEEN $3.5 AND $4.0 MILLION OF REIMBURSABLE FUNDS.

CORE MEASUREMENT RESEARCH FOR NEW TECHNOLOGIES SUBACTIVITY

The Core Measurement Research for New Technologies Subactivity includes programs in both the National Engineering Laboratory (NEL) and the National Measurement Laboratory (NML). NEL's Semiconductor Program and Automated Manufacturing Research Program are part of this Subactivity.

Semiconductor Program

In FY 1982 and FY 1983 this program was funded at $4,793K (74 positions) and $4,977K (73 positions) respectively. The FY 1984 budget continues this program at $5,489K (80 positions). Reimbursable support for the program in FY 1983 and FY 1984 is less than a million dollars.

In our semiconductor programs we provide measurement methods and related technology in critical problem areas and the underlying fundamental research necessary to conduct these projects.

Technical trends include increasing use of digital signal processing and control circuitry in a wide variety of applications. These trends are driven by several developments, the most significant of which is fabrication of interconnected circuit elements on a single chip of silicon at ever smaller dimensions and increasing density and complexity of electronic functions. These trends in integrated circuitry have led to a dramatic decrease in the size and the price of digital processors which, together with an increase in speed and complexity, has significantly improved their performance.

THE FOLLOWING ARE A FEW DEVELOPMENTS WHICH GIVE AN IDEA OF THE NATURE OF OUR WORK.

- o NBS HAS RECEIVED OVER 70 REQUESTS FOR PROGRAM AND DOCUMENTATION FOR ITS TWO-DIMENSIONAL CHARGE-SHEET MODEL FOR SHORT-CHANNEL METAL OXIDE-SEMICONDUCTOR FIELD-EFFECT TRANSISTORS (MOSFETS). THE MODEL USES NUMERICAL SIMULATION, BASED ON KEY PHYSICAL PARAMETERS, TO DETERMINE THE OUTPUT VOLTAGES AND CURRENTS FROM MOS TRANSISTORS. THE SIMULATION WILL BE ESPECIALLY USEFUL FOR OUR EFFORTS TO OPTIMIZE METHODS OF MEASURING THE ELECTRICAL PERFORMANCE OF SUCH DEVICES AS WELL AS IMPROVING THE GEOMETRICAL DESIGN.

- o A NEW SILICON RESISTIVITY STANDARD REFERENCE MATERIAL, SRM, HAS BEEN RELEASED BY NBS. RESISTIVITY IS THE SINGLE MOST IMPORTANT PARAMETER SPECIFIED BY THE SEMICONDUCTOR INDUSTRY FOR THE STARTING MATERIAL FROM WHICH ELECTRONIC DEVICES ARE MADE. THIS SRM IS INTENDED PRIMARILY AS A MEANS FOR CALIBRATING INSTRUMENTS FOR MEASURING THE RESISTIVITY OF SILICON SLICES OR WAFERS WITHOUT PHYSICALLY CONTACTING THE FRONT SURFACE OF THE SLICE OR WAFER WITH A PROBE.

- o THIS PROGRAM HAS DEMONSTRATED A MODIFIED SPREADING RESISTANCE PROFILING TECHNIQUE. THESE MEASUREMENTS EXHIBIT A MEASUREMENT RESOLUTION FOR THE RAW DATA OF 1 TO 2.5 NM, A PERFORMANCE THAT APPROACHES AN ORDER OF MAGNITUDE IMPROVEMENT OVER RESULTS PUBLISHED TO DATE. THIS MEASUREMENT IS IMPORTANT IN SUPPORT OF SILICON FOUNDRY MARKETPLACE INTERACTIONS, I.E., TO PROVIDE ASSURANCE TO THE FOUNDRY CUSTOMER THAT THE DESIGN WAS EXECUTED AS SPECIFIED.

o A new artifact for the measurement of flare in reflected-light optical systems has been developed. The artifact was developed in conjunction with the work on the measurement of linewidth on semiconductor wafers; the presence of flare introduces an error in linewidth determination resulting from the shift in detection threshold.

In the next two years our metrology for the integrated circuit industry will continue to evolve as dimensions on chips become even smaller and packing density and speed continue to increase. We are establishing a new capability for producing standards for smaller chip dimensions using electron rather than optical microscopy.

Automated Manufacturing Research

This program includes Automated Manufacturing Interface Standards, Mechanical Engineering Metrology, and Automated Manufacturing Research Facility. In FY 1982 and FY 1983 these programs were funded at $6,094K (104 positions) and $7,430K (114 positions) respectively. The FY 1984 budget continues this program at $6,218K (104 positions). While the appropriated funds are proposed to be reduced in FY1984, the program should not be adversely effected since other sources of support are developing. For example, the program is benefiting from equipment loans from the private sector, research associates and visiting scientists (neither of which cost NBS any direct salary cost), and anticipated increased support by other Federal agencies, notably the U.S. Navy.

THE COMPLETELY AUTOMATED SMALL-BATCH MANUFACTURING SYSTEM OR FLEXIBLE MANUFACTURING SYSTEM CONSISTS OF ELEMENTS SUCH AS METAL-CUTTING MACHINES, COMPUTERS, TERMINALS, ROBOTS, CONVEYERS, AND MEASURING OR INSPECTION SYSTEMS. THE SMALL-BATCH MANUFACTURER WHO WISHES TO AUTOMATE WILL USUALLY BUY THE VARIOUS COMPONENTS FROM SEVERAL MANUFACTURERS IN ORDER TO MEET HIS SPECIFIC NEEDS. THE BUYER IS THEN FACED WITH THE PROBLEM OF MAKING THE VARIOUS COMPONENTS WORK TOGETHER. SOME VERY SOPHISTICATED COMPANIES CAN DO THIS. HOWEVER, MOST OF THE SMALL-BATCH MANUFACTURERS LACK THE REQUIRED TECHNICAL CAPABILITY. THIS INABILITY TO COMBINE EQUIPMENT FROM DIFFERENT MANUFACTURERS IS A SERIOUS BARRIER TO THE ADOPTION OF THIS TECHNOLOGY. EACH PAIR OF DEVICES REQUIRES INTERFACES AND IN PARTICULAR SOFTWARE INTERFACES. THESE MUST BE AGREED UPON AMONG THE VARIOUS PRODUCERS AND USERS AND WILL BE PRIMARILY PUT IN PLACE BY THE ACTIONS OF THE VOLUNTARY STANDARDS COMMUNITY.

OUR PROGRAM ON AUTOMATED MANUFACTURING HAS TWO THRUSTS: DEVELOPMENT OF THE MEASUREMENT TECHNOLOGY NEEDED TO ASSURE THE DIMENSIONAL QUALITY OF THE PARTS, AND PROVISION OF THE TECHNICAL BASIS FOR SOFTWARE INTERFACE STANDARDS. DETAILS OF THIS PROGRAM ARE INCLUDED IN TESTIMONY I GAVE BEFORE THIS SUBCOMMITTEE LAST WINTER AND THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT LAST JUNE. THE PROGRAM IS MOVING AHEAD VERY QUICKLY.

o EFFORTS ON MEASUREMENT TECHNOLOGY TO PREDICT AND CORRECT ERRORS IN A MAJOR MACHINE TOOL HAVE ENABLED US TO MACHINE A VERY DIFFICULT PART FOR THE BUREAU OF PRINTING AND ENGRAVING IN A MANNER IMPOSSIBLE TO DO ON THIS TOOL OTHERWISE. THIS IS A KEY FIRST STEP IN DEVELOPING WHAT WE CALL DETERMINISTIC METROLOGY FOR THE FACTORY OF THE FUTURE.

- We have shown that the Interim Graphics Exchange Specification, IGES, (a software interface standard) performs as expected for a variety of commercial Computer-Aided Design systems. Systems conforming to IGES are now widely offered for sale.

- We have shown the feasibility of our approach to hierarchical control using a network of microprocessors sharing a common data base in a common memory.

- A proposed work station in the Automated Manufacturing Research Facility (AMRF) has been modelled on a computer so that we can do certain research tasks necessary for setting up the actual AMRF.

- The AMRF is taking shape. We have had one cell (robot cart, robot, and vertical milling machine) working under computer control and are now setting up a second cell.

- We have received loans of 3 major capital items (value of about $500,000) from industry; we have 10 research associates from industry and 4 university researchers working at NBS in the program.

The automation program is on schedule and will be producing more and more results in the next two years. We shall see several more software interface standards and the metrology of the factory of the future will take shape.

FIRE RESEARCH SUBACTIVITY

THE NBS BUDGET FOR FY1984 PROPOSES ELIMINATION OF THE CENTER AND ITS FIRE RESEARCH PROGRAM, A REDUCTION OF $5,886K (40 POSITIONS). THE FIRE RESEARCH PROGRAM CONTRIBUTES TECHNICAL INFORMATION FOR BUILDING CODES, AN AREA THAT IS PRIMARILY THE RESPONSIBILITY OF STATE AND LOCAL GOVERNMENTS. SIGNIFICANT BENEFITS ACCRUE TO THE CONSTRUCTION COMMUNITY THROUGH REDUCED CONSTRUCTION COSTS. THE CONSTRUCTION COMMUNITY, IN COOPERATION WITH STATE AND LOCAL BUILDING CODE OFFICIALS, CAN CARRY OUT RESEARCH IN THIS FIELD BY SUPPORTING WORK AT QUALIFIED PRIVATE LABORATORIES AND AT UNIVERSITIES. ASSUMING CONGRESSIONAL APPROVAL OF THIS PROPOSAL, THE REIMBURSABLE WORK (APPROXIMATELY $2.4 MILLION IN FY83) WILL BE PHASED OUT IN FY1984 AND THE CENTER FOR FIRE RESEARCH WILL BE CLOSED DOWN DURING THAT YEAR.

THE CENTER FOR FIRE RESEARCH PROVIDES TECHNICAL INFORMATION USED BY THE STANDARDS AND CODES COMMUNITIES FOR BUILDING REGULATIONS AND PRODUCT STANDARDS FOR FIRE SAFETY. PROGRAM ACTIVITY INCLUDES BASIC RESEARCH ON FIRE PHENOMENA AND THE APPLIED WORK NEEDED TO CONVERT NEW RESEARCH FINDINGS INTO TEST METHODS AND PROPOSALS FOR IMPROVED STANDARDS AND CODE PROVISIONS. THE CENTER SPONSORS THE MAJORITY OF U.S. ACADEMIC RESEARCH ON FIRE THROUGH ABOUT 15 TO 20 RESEARCH GRANTS WORTH ABOUT $2 MILLION IN FY83. THE CENTER ALSO SERVES AS THE CENTRAL FIRE LABORATORY FOR THE U.S. GOVERNMENT AND, IN THAT ROLE, CONDUCTS REIMBURSABLE WORK FOR MANY FEDERAL AGENCIES.

ACCOMPLISHMENTS RANGE FROM NEW BASIC RESEARCH FINDINGS TO IMPROVEMENTS IN ASSESSING FIRE HAZARD AND RECOMMENDING EFFECTIVE FIRE PREVENTION RESPONSES.

o Researchers are applying sophisticated laser probes to study the chemistry of flames. By examining features of the ultraviolet spectrum we are learning details of the reactions occurring early in the flame history and reactions leading to the formation of soot particles. We hope to understand this process well enough to fredict how to eliminate sooting and thereby reduce radiative heat transfer from the flame in all directions. Good progress is being made on a number of species we believe to be key to the phenomenon.

o Progress continues on our mathematical models of fire in rooms. Some of the models are now on computer graphics systems so that one can conduct fire experiments on the console. We have modelled fire spread laterally and vertically on walls and learned how to use results of specific bench tests to predict this spread. And we have extended our models from one room to several. We are now confident that much of our testing and code decision making will, in a few years, be done on computer thereby speeding the approval process and reducing the cost.

o We published a lengthy report on the NBS test procedure for evaluating the toxicity of combustion products in fire. This test is suitable for pure materials but not for most composites (e.g., carpets with integral backing). The procedure is intended primarily for research and screening of proposed new products by manufacturers. There is interest in the method in the standards and codes communities and we are working this year to address those problems which thus far render it difficult for these groups to use the test.

- The NBS Fire Safety Evaluation System continues to find new applications. It was first applied to hospitals, then to intermediate board and care facilities. The latter application will be included in the next edition of the National Fire Protection Association Life Safety Code (the former is already in it). Adaptations are under development for multi-family housing units, for correctional facilities, for structures operated by the U.S. Park Service, and for coal mines. The System enables one to use a number of different design options to reach a specific level of fire safety. It produces cost savings and design flexibility.

Mr. Chairman, this concludes my prepared testimony. I shall be pleased to answer any questions you, or other members of the Subcommittee, may have.

Mr. Reid. Thank you, Dr. Lyons.

Dr. Ambler, who would you ask to present their testimony next?

Dr. Ambler. I'd like Dr. Johnson to go next.

Mr. Reid. Please proceed, Dr. Johnson

Dr. Johnson. Thank you, Mr. Chairman.

I'd like to thank you for this opportunity to meet with you here today and describe the activities of the National Measurement Laboratory. With your permission, I'd also like to summarize my statement today if I could, and present the full statement for the record, Mr. Chairman.

Mr. Reid. Your full statement will be made part of the record.

Dr. Johnson. Thank you.

[A biographical sketch of Dr. Johnson follows:]

DONALD R. JOHNSON

Date of Birth: July 19, 1938 Birthplace: Tacoma, Washington

Education: Degrees

University of Puget Sound, B.S., Physics, 1960
University of Idaho, M.S., Physics, 1962
University of Oklahoma, Ph.D., Physics, 1967

Position

As Director of the National Measurement Laboratory Dr. Johnson is responsible for developing and maintaining the scientific competences and experimental facilities necessary to provide the United States with a central basis for uniform physical and chemical measurements, measurement methodology, and specifications of properties that determine the performance of materials.

He served as Deputy Director for Resources and Operations of the National Measurement Laboratory from 1980 to 1982 providing executive direction for the five major technical Centers of the Laboratory and as Deputy Director for Programs from 1978 to 1980 with direction for the matrix managed programs of the Laboratory which addressed specific national needs for interdisciplinary measurement and data services.

After joining NBS as a physicist in 1967, he became involved in basic research which focused on the development of instrumentation and techniques for studying short-lived molecules in complex-chemical systems. The results of these efforts have found application in physics, chemistry, aeronomy and radio astronomy. Dr. Johnson has also been directly involved in numerous radio telescope observations and participated in the discovery of several new interstellar molecules.

Over 60 original scientific papers have been authored (or co-authored) by Dr. Johnson and he has received both Silver and Gold Medals from the Dept. of Commerce for research accomplishments. He was recipient of the Arthur S. Flemming Award as one of the ten outstanding young men in Federal service in 1976 and the Senior Executive Service Meritorious Award in 1981.

He serves on the Board of the Directors of the American Society for Testing and Materials and the Council of the American Physical Society. He is a member of the American Association for the Advancement of Science, the American Astronomical Society, the International Astronomical Union, and the Sigma Xi.

Dr. Johnson has been a leader in civic matters in his community serving on the Board of Directors and as President of his neighborhood Citizens Association. He has also been a member of the Shady Grove Sector Plan Advisory Committee for Montgomery County, Vice Chairman of the Gaithersburg Bicentennial Coordinating Committee and the Gaithersburg City Planning Commission, holding its chairmanship from 1977 to 1983.

STATEMENT OF DR. DONALD R. JOHNSON, DIRECTOR, NATIONAL MEASUREMENT LABORATORY, NATIONAL BUREAU OF STANDARDS

Dr. JOHNSON. The National Measurement Laboratory develops and disseminates the national physical and chemical standards of measurement. We have a specific mandate to develop new and sophisticated measurement techniques to characterize the properties and performance of materials. We develop, produce, and market standard reference materials. We make available data bases of physical and chemical properties and we offer direct calibration and measurement services to the technical and general public. In addition, we provide advisory services and research services to other Government agencies.

The National Measurement Laboratory currently employs a staff of 822 full-time employees, plus an additional 525 part-time employees, industrial research associates, guest workers, and students. Our appropriated budget under the subactivity Measurement Research and Standards in fiscal year 1983 is $47,516,000 and we anticipate approximately $31 million in reimbursement for services.

In response to the administration's policy to reduce costs, and recover costs of specific services from those who benefit directly, we propose programmatic reductions in this area of approximately $3.5 million for fiscal year 1984.

These decreases come in four areas: First, a decrease of $527,000 and four positions is proposed in the area of nonmetallic materials. NBS will curtail its research efforts in chemical biodegradation of materials and electrical conductivity of polymers. A portion of these funds may be replaced from other Federal agencies that have specific applications for this work.

The second area: a decrease of $1,933,000 and 23 positions is proposed in the measurement assurance program. In previous years, these resources have been used to support the research and development required to establish new measurement assurance services. Past practice has been to use appropriated funds for MAP research and development and then to recover the incremental costs of providing the services through fees to the users. It is proposed that the existing MAP fees be increased to generate additional revenue that can be applied toward the development of new services.

In the third area, a decrease of $1 million is proposed in the area of recycled oil. Now, these funds were restored by Congress in fiscal year 1983 to allow us to complete the field validation, or field testing, of laboratory measurement methods and characterization procedures, which were developed earlier in the program at NBS. By the end of fiscal year 1983, this work will have progressed to the point where the private sector can support any further efforts that may be needed.

Fourth: we are also requesting a decrease of $438,000 under the subactivity central technical support. These funds cover standard reference material production replacement costs. Legislation has been submitted to allow NBS to charge and retain full replacement costs from the sale of SRM's.

With this legislation in place, the $438,000 will not be needed.

Mr. Chairman, this concludes my formal presentation and, again, I will also be happy to answer any questions.

[The prepared statement of Dr. Johnson follows:]

U.S. DEPARTMENT OF COMMERCE
STATEMENT OF
DONALD R. JOHNSON
ACTING DIRECTOR, NATIONAL MEASUREMENT LABORATORY
NATIONAL BUREAU OF STANDARDS

BEFORE THE

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
ON AUTHORIZATION OF APPROPRIATIONS FOR FISCAL YEAR 1984
MARCH 22, 1983

MR. CHAIRMAN, MEMBERS OF THE SUBCOMMITTEE:

I'D LIKE TO THANK YOU FOR THIS OPPORTUNITY TO MEET WITH YOU TODAY AND TO DESCRIBE THE MEASUREMENT RESEARCH AND STANDARDS ACTIVITIES IN THE NATIONAL MEASUREMENT LABORATORY AT THE NATIONAL BUREAU OF STANDARDS.

° OVERVIEW

THE NATIONAL MEASUREMENT LABORATORY DEVELOPS AND DISSEMINATES THE NATIONAL PHYSICAL AND CHEMICAL STANDARDS OF MEASUREMENT. THIS WORK IS CARRIED OUT IN RESPONSE TO THE NEEDS OF SCIENCE, INDUSTRY, COMMERCE, AND GOVERNMENT. THE STANDARDIZATION NEEDS OF OUR COUNTRY ARE OF SUCH BREADTH THAT WE MUST MAINTAIN SCIENTIFIC COMPETENCES AND EXPERIMENTAL FACILITIES IN VIRTUALLY ALL AREAS OF PHYSICAL AND CHEMICAL SCIENCE. WE HAVE A SPECIFIC MANDATE TO DEVELOP NEW AND SOPHISTICATED MEASUREMENT TECHNIQUES TO CHARACTERIZE THE PROPERTIES AND PERFORMANCE OF MATERIALS. WE INVESTIGATE COMPLEX CHEMICAL SYSTEMS AND

DEVELOP, PRODUCE, AND MARKET STANDARD REFERENCE MATERIALS. WE MAKE AVAILABLE DATA BASES OF PHYSICAL AND CHEMICAL PROPERTIES UNDER THE PROVISIONS OF THE STANDARD REFERENCE DATA ACT, AND WE OFFER DIRECT CALIBRATION AND MEASUREMENT SERVICES TO THE TECHNICAL AND GENERAL PUBLIC. IN ADDITION, WE PROVIDE ADVISORY AND RESEARCH SERVICES TO OTHER GOVERNMENT AGENCIES.

THE RESULTS OF OUR WORK ARE USED WIDELY BY U.S. INDUSTRY. FOR EXAMPLE: STANDARD REFERENCE MATERIALS ARE REGULARLY USED TO ASSURE THE QUALITY OF INDUSTRIAL PRODUCTS. STANDARD REFERENCE DATA ARE USED TO DESIGN NEW INDUSTRIAL PROCESSES AND ARE INCORPORATED IN INSTRUMENTATION FOR RAPID IDENTIFICATION OF UNKNOWN COMPOUNDS. OUR CALIBRATION AND MEASUREMENT SERVICES PROVIDE INDUSTRY WITH DIRECT TRACEABILITY TO NATIONAL STANDARDS OF PHYSICAL MEASUREMENT.

° ACCOMPLISHMENTS

MR. CHAIRMAN, OUR ACCOMPLISHMENTS DURING THE PAST YEAR ARE A REFLECTION OF THE MANY WAYS THAT THE LABORATORY HAS RESPONDED, AND WILL CONTINUE TO RESPOND TO THE BROAD NATIONAL NEEDS FOR OUR SERVICES. I HAVE SELECTED A FEW EXAMPLES THAT I FEEL SET A TONE FOR THE KIND OF EFFORTS THAT YOU CAN EXPECT FROM US IN THE FUTURE.

DURING THE PAST YEAR, WE EMBARKED ON A MAJOR PROGRAM IN PARTNERSHIP WITH THE AMERICAN SOCIETY FOR METALS (ASM), TO MAKE COMPUTER-READABLE PHASE DIAGRAMS AVAILABLE TO THE

METALS PROCESSING INDUSTRY. MORE THAN $3,000,000 HAS BEEN PLEDGED BY THE INDUSTRY IN SUPPORT OF THIS EFFORT. RELIABLE PHASE DIAGRAMS, WHICH DISPLAY THE BEHAVIOR OF ALLOYS RELATIVE TO CHANGES IN PROCESS VARIABLES, ARE IMPORTANT TO A VARIETY OF JOBS SUCH AS THE DESIGN OF NEW ALLOYS FOR HIGH TECHNOLOGY APPLICATIONS. OVER 20 TITANIUM ALLOY SYSTEMS WERE EVALUATED THIS PAST YEAR WHICH ARE OF INTEREST FOR THEIR LIGHT WEIGHT AND HIGH STRENGTH. ASM ESTIMATES THAT THE DATA EMANATING FROM THIS PROGRAM WILL SAVE THE INDUSTRY 5000 TIMES THE COSTS OF COMPILING THE DATA.

A NEW METALS PROCESSING LABORATORY HAS BEEN COMPLETED DURING THIS PAST YEAR WHICH PROVIDES RESEARCH FACILITIES FOR INVESTIGATING RAPID SOLIDIFICATION PROCESSES. RAPIDLY COOLED METALS WITH NEW COMPOSITIONS AND-MICROSTRUCTURAL ARRANGEMENTS EXHIBIT UNIQUE PROPERTIES WHICH CAN BE TAILORED TO SUIT THE DEMANDS OF A SPECIFIC APPLICATION. OUR GROWING CAPABILITY IN THIS AREA WILL RESULT IN NEW UNDERSTANDING OF THE RELATIONSHIPS BETWEEN PROCESSING VARIABLES AND PHYSICAL PROPERTIES SUCH AS STRENGTH AND CORROSION RESISTANCE. WE ARE STRONGLY COUPLED TO INDUSTRY AND EXPECT TO USE RESEARCH ASSOCIATES WHO WILL BE COLLABORATING WITH US ON THESE NEW FACILITIES.

SOPHISTICATED LASER PROCESSES FOR REMOVING ENERGY FROM, OR "COOLING," IONS AND ATOMS TO NEAR ABSOLUTE ZERO HAVE BEEN DEVELOPED IN OUR PRIMARY STANDARDS LABORATORIES. THE USE OF

THESE COOLED ATOMIC PARTICLES WILL PERMIT THE DEVELOPMENT OF A TIME STANDARD 100 TIMES MORE ACCURATE THAN THOSE CURRENTLY AVAILABLE. SUCH AN IMPROVED TIME STANDARD WILL, FOR EXAMPLE, PROVIDE FOR SECURE HIGH-LEVEL GOVERNMENT COMMUNICATIONS, IMPROVED MILITARY NAVIGATION SYSTEMS, MEET NASA'S SPACE NAVIGATION NEEDS AFTER 1990 AND OPEN THE WAY FOR SCIENCE APPLICATIONS IN RADIO-ASTRONOMY AND GRAVITY WAVE DETECTION. THESE DEVELOPMENTS ALSO WILL FORM THE FOUNDATION FOR MANY OF OUR PRECISION MEASUREMENT EFFORTS IN THE FUTURE.

NEW SERVICES WERE OFFERED TO THE CHEMICAL INDUSTRY THIS PAST YEAR IN THE FORM OF COMPUTER READABLE CHEMICAL DATA. THE NBS CRYSTAL DATA IDENTIFICATION FILE AND THE NBS CHEMICAL THERMODYNAMICS DATABASE HAVE BEEN RELEASED FOR PUBLIC USE ON THE CHEMICAL INFORMATION SYSTEM. THESE DATABASES REPRESENT THE FIRST OF WHAT WE EXPECT TO BE A LONG SERIES OF MACHINE-READABLE DATABASES. THE CONCEPT OF A MASTER DATABASE, MAINTAINED IN MACHINE-READABLE FORM BY AN NBS DATA CENTER AND DESIGNED FOR EFFICIENT PRODUCTION OF PRINTED TABLES, MAGNETIC TAPES AND OTHER FORMS OF OUTPUT, OFFERS READY ACCESS TO UP-TO-DATE, RELIABLE DATA FOR ALL USERS. THE CHEMICAL INFORMATION SYSTEM IS ACCESSIBLE OVER COMMERCIAL COMPUTER NETWORKS, AND IS A JOINT PROJECT BETWEEN THE NATIONAL INSTITUTES OF HEALTH AND THE ENVIRONMENTAL PROTECTION AGENCY IN COLLABORATION WITH THE NATIONAL BUREAU OF STANDARDS, THE FOOD AND DRUG ADMINISTRATION AND OTHER FEDERAL AGENCIES. BOTH THE CRYSTAL DATA IDENTIFICATION FILE AND THE CHEMICAL THERMODYNAMICS DATA FILE ARE ALSO AVAILABLE FOR SALE ON MAGNETIC TAPE.

TRAINING OF TECHNICAL PERSONNEL FROM OUR USER COMMUNITY HAS ALWAYS BEEN AN IMPORTANT MEANS OF TRANSFERRING OUR KNOWLEDGE FROM THE LABORATORY INTO PRACTICE. DURING THE PAST YEAR, WE SPONSORED 50 CONFERENCES, SEMINARS AND WORKSHOPS WHICH INVOLVED MORE THAN 2000 PARTICIPANTS FROM GOVERNMENT AND PRIVATE SECTOR LABORATORIES. ONE OF THE MOST POPULAR WAS A SERIES OF FIVE SEMINARS ON "QUALITY ASSURANCE OF CHEMICAL MEASUREMENT" CONDUCTED BY OUR SENIOR STAFF. THE 245 ATTENDEES CONSISTED OF LABORATORY SUPERVISORS, SENIOR ANALYSTS AND DIRECTORS OF QUALITY ASSURANCE PROGRAMS FROM MORE THAN 100 DIFFERENT ORGANIZATIONS WHO WERE INTERESTED IN IMPLEMENTING OR IMPROVING QUALITY ASSURANCE EFFORTS IN THEIR COMPANIES.

- PLANS

LOOKING TO THE FUTURE, WE WILL OF COURSE CONTINUE TO EMPHASIZE THE DELIVERY OF MEASUREMENT SERVICES TO ALL SEGMENTS OF THE ECONOMY. OUR PRIMARY MECHANISMS FOR TRANSFERRING TECHNOLOGY, CALIBRATIONS, STANDARD REFERENCE MATERIALS, STANDARD REFERENCE DATA AND TRAINING SEMINARS WILL EVOLVE AS THE NEEDS OF OUR CUSTOMERS CHANGE. FOR EXAMPLE, WE HAVE ALREADY BEGUN WORK IN TWO OF OUR CENTERS ON BIOLOGICALLY ACTIVE MOLECULES. PLANS CALL FOR NEAR-TERM RESULTS WHICH WILL LEAD TO NEW AND BETTER CLINICAL STANDARDS IN ENZYME ANALYSIS. LONGER-TERM GOALS ARE TO CHARACTERIZE BIOLOGICALLY ACTIVE SUBSTANCES WHICH ARE BEGINNING TO BE SIGNIFICANT IN INDUSTRIAL PROCESSES.

THE PHASE DIAGRAM PROGRAM WHICH I MENTIONED EARLIER IS REALLY STILL DEVELOPING. THIS COMING YEAR WE WILL COMPLETE EVALUATIONS OF ALUMINUM, IRON, AND TITANIUM BASED BINARY PHASE DIAGRAMS, AND IMPLEMENT AN INTERACTIVE COMPUTER PROGRAM FOR THE OPTIMIZATION OF TERNARY PHASE DIAGRAMS.

A NEW METHODOLOGY OF USING NEUTRONS TO PROBE THE DEPTH DISTRIBUTION OF ELEMENTS LIKE HELIUM, BISMUTH, AND NITROGEN IN SOLID MATERIALS WILL PROVIDE NON-DESTRUCTIVE, THREE DIMENSIONAL, COMPOSITIONAL ANALYSIS OF CRITICAL HIGH TECHNOLOGY MATERIALS. A PILOT VERSION OF THIS INTERESTING PROCEDURE WHICH "SEES" ONLY SELECTED ELEMENTS, WON AN IR-100 AWARD THIS YEAR FROM INDUSTRIAL RESEARCH MAGAZINE.

A NEW MEASUREMENT TECHNIQUE WILL BE UNDER DEVELOPMENT THIS YEAR FOR INVESTIGATING DELAMINATION OF POLYMER MATRIX COMPOSITES. COMPOSITE MATERIALS ARE INCREASINGLY USED IN THE AIRCRAFT AND AUTO INDUSTRIES. THIS TECHNIQUE WILL LEAD TO DESIGN IMPROVEMENTS TO CONTROL IN-SERVICE FAILURE OF THESE STRUCTURAL COMPOSITES.

WE WILL DEVELOP THEORETICAL MODELS FOR PREDICTING INTERACTION ENERGIES AND REACTION PATHWAYS OF COMPLEX ORGANIC MOLECULES. THIS INFORMATION IS NEEDED BY THE PRIVATE SECTOR TO IMPROVE EFFICIENCY AND EFFECTIVENESS OF INDUSTRIAL CHEMICAL PROCESSES.

WE WILL COMPLETE AN OPERATIONAL INTERCONTINENTAL TIME TRANSFER SYSTEM WITH 10-NANOSECOND, OR 10 BILLIONTHS OF A SECOND, ACCURACY IN ORDER TO FULFILL NBS'S RESPONSIBILITIES FOR NATIONAL AND INTERNATIONAL TIME COORDINATION.

A NEW NATIONAL STANDARD OF RADIATION DOSE WILL BE ESTABLISHED, TO ENABLE IMPROVED ACCURACY AND QUALITY CONTROL IN MEASUREMENT OF HOW RADIATION AFFECTS THE HUMAN BODY IN SUCH APPLICATIONS AS CANCER THERAPY.

A NEW SERIES OF LOW-LEVEL RADIOACTIVE NATURAL-MATIX SRMS WILL BE DEVELOPED FOR USE IN MONITORING NUCLEAR POWER REACTOR SITES.

A NEW CONTINUOUS-WAVE ELECTRON ACCELERATOR WILL BE UNDER CONSTRUCTION THIS YEAR. THIS DEVICE IS A PROTOTYPE OF FUTURE LARGE-SCALE ACCELERATORS BEING PLANNED BY THE DEPARTMENT OF ENERGY AND WILL FIND A MULTITUDE OF APPLICATIONS IN FUTURE NBS RADIATION RESEARCH AND STANDARDIZATION WORK.

MR. CHAIRMAN, THE LIST OF OUR PROPOSED ACTIVITIES FOR THE NEXT YEAR IS INDEED VERY LENGTHY AND I HOPE THAT THE FEW EXAMPLES THAT I HAVE JUST CITED WILL SERVE TO ILLUSTRATE THE NATURE OF THE WORK THAT WE HAVE PLANNED. I WOULD LIKE TO TURN YOUR ATTENTION TO SPECIFICS OF OUR PROPOSED FY 84 BUDGET.

- FY 84 BUDGET

THE NATIONAL MEASUREMENT LABORATORY CURRENTLY EMPLOYS A STAFF OF APPROXIMATELY 825 FULL-TIME CAREER EMPLOYEES PLUS APPROXIMATELY 525 PART-TIME EMPLOYEES, INDUSTRIAL RESEARCH ASSOCIATES, GUEST WORKERS AND STUDENT TRAINEES. OUR APPROPRIATED BUDGET UNDER THE SUBACTIVITY, MEASUREMENT RESEARCH AND STANDARDS, IN FY 83 IS $47,516,000 AND WE ANTICIPATE APPROXIMATELY $31,231,000 IN REIMBURSEMENT FOR SERVICES TO OTHER AGENCIES, SALES OF STANDARD REFERENCE MATERIALS, AND CALIBRATION SERVICES. IN RESPONSE TO THE ADMINISTRATION'S POLICY TO REDUCE COSTS AND TO RECOVER THE COSTS OF SPECIFIC SERVICES FROM THOSE WHO BENEFIT DIRECTLY, WE PROPOSE TO REDUCE OUR REQUEST FOR APPROPRIATIONS IN FOUR AREAS OF THE LABORATORY'S BUDGET FOR FY 84. IN THIS SUBACTIVITY WE ARE REQUESTING A PROGRAMMATIC DECREASE OF $3,522,000.

A DECREASE OF $62,000 AND 0 POSITIONS IS PROPOSED IN FY 84 FOR TRAINING SERVICES RELATED TO FUNDAMENTAL PHYSICAL QUANTITIES. WE PROPOSE TO RECOVER THE COST OF PREPARING AND CONDUCTING WORKSHOPS THROUGH INCREASED REGISTRATION FEES. THUS, NBS HAS NO INTENTION OF CUTTING BACK ON THESE WORKSHOP ACTIVITIES BUT RATHER IS PROPOSING TO PLACE THEM ON THE SAME FULL COST RECOVERY BASIS AS WORKSHOPS IN OTHER AREAS.

A DECREASE IN DIRECT APPROPRIATIONS OF $527,000 AND 4 POSITIONS IS PROPOSED IN THE AREA OF NONMETALLIC MATERIALS. SPECIFICALLY, NBS WILL CURTAIL ITS RESEARCH EFFORTS IN TWO AREAS. FIRST, THE RESEARCH INTO CHEMICAL BIODEGRADATION PROCESSES OF MATERIALS IN CONTACT WITH WATER OR SOIL WILL BE REDUCED. THIS WORK IS AIMED AT UNDERSTANDING AND CONTROLLING THE PROCESSES WHICH ARE A SUBSTANTIAL CAUSE OF DETERIORATION. SECOND, THE RESEARCH INTO ELECTRO-CONDUCTIVITY OF POLYMERS WILL BE REDUCED. THIS WORK IS AIMED AT SYNTHESIS, SAMPLE PREPARATION, AND PHYSICAL CHARACTERIZATION OF SYNTHETIC ELECTRONIC CONDUCTING SOLIDS, MOST NOTABLY POLYACETYLENE. A PROPORTION OF THESE FUNDS MAY BE REPLACED BY REIMBURSEMENTS FROM OTHER FEDERAL AGENCIES THAT HAVE SPECIFIC APPLICATIONS FOR THIS WORK. IN ADDITION, MUCH OF THE WORK HAS REACHED A POINT OF MATURITY THAT ENABLES IT TO BE TRANSFERRED TO THE PRIVATE SECTOR.

A DECREASE IN DIRECT APPROPRIATIONS OF $1,933,000 AND 23 POSITIONS IS PROPOSED IN THE MEASUREMENT ASSURANCE PROGRAM (MAP) AND THE REGIONAL MEASUREMENT ASSURANCE PROGRAM (RMAP). IN PREVIOUS YEARS THESE RESOURCES HAVE BEEN USED TO SUPPORT THE RESEARCH AND DEVELOPMENT REQUIRED TO ESTABLISH NEW MEASUREMENT ASSURANCE SERVICES AND TO INITIATE THE TRANSFER OF THESE SERVICES TO USERS. THE INTRODUCTION OF A NEW MAP/RMAP SERVICE TYPICALLY REQUIRES SEVERAL YEARS OF RESEARCH AND DEVELOPMENT BEFORE THE SERVICE CAN BE OFFERED TO THE PUBLIC. MAP SERVICES ARE CURRENTLY UNDER DEVELOPMENT IN HIGH-PRIORITY AREAS SUCH AS MICROWAVE POWER AND X-RAY RADIATION EXPOSURE. PAST PRACTICE HAD BEEN TO USE APPROPRIATED FUNDS for the MAP/RMAP research and development and then to recover the incremental costs of providing the service to the public and other Government agencies through participation fees. It is proposed that the existing MAP and RMAP fees be increased to generate additional revenue that can be applied towards the development of new services in other technical areas. NBS will work with the entire user community in fiscal year 1983 to plan the transition to the new mode of operation so as to minimize problems for those who rely on NBS services. NBS will continue to provide MAP and RMAP services to the maximum extent possible under the cost recovery funding plan.

A decrease of $1,000,000 and 0 positions is proposed in the area of Recycled Oil, thereby eliminating all direct appropriations for this effort. These funds were originally proposed for termination at the beginning of FY83 but were restored by Congress until the end of FY83 to allow us to complete the field validation of the laboratory measurement methods and characterization procedures for re-refined oil which were developed earlier in the program. The field validation has also proved to be an excellent mechanism for transferring this technology to the user community. By the end of the current year this work will have progressed to the point where it will be appropriate for the private sector to support any further efforts that are necessary to satisfy their own specific requirements.

WE ARE ALSO REQUESTING A DECREASE OF $438,000 AND 0 POSITIONS UNDER THE SUBACTIVITY, CENTRAL TECHNICAL SUPPORT. THESE FUNDS COVER SRM PRODUCTION REPLACEMENT COSTS. LEGISLATION HAS BEEN SUBMITTED WHICH ALLOWS NBS TO CHARGE AND RETAIN REPLACEMENT COSTS FROM THE SALE OF SRMS.

THE NATIONAL MEASUREMENT LABORATORY IS COMMITTED AND DEDICATED TO SERVING THE NATION IN THE MOST EFFECTIVE WAYS POSSIBLE. WE WILL CONTINUE TO PROMOTE THE DEVELOPMENT OF HIGH QUALITY SCIENCE AND TECHNOLOGY IN THE UNITED STATES THROUGH PROVISION OF MEASUREMENTS, STANDARDS, AND DATA. WE STAND READY TO ACT AS A THIRD PARTY IN TECHNICAL DISPUTES, AND TO ASSIST THOSE MAKING TECHNICAL AND SCIENTIFIC DECISIONS.

MR. CHAIRMAN, THIS CONCLUDES MY FORMAL PRESENTATION. I WOULD BE HAPPY TO RESPOND TO ANY QUESTIONS YOU OR ANY MEMBERS OF THE SUBCOMMITTEE MAY HAVE.

Mr. **REID**. Thank you, Dr. Johnson, for testifying.

Dr. Ambler, who is next?

Dr. **AMBLER**. Mr. Burrows.

Mr. **REID**. Mr. Burrows, would you proceed?

Mr. **BURROWS**. Thank you, Mr. Chairman.

I'd like to summarize my written statement and request that my formal statement be entered into the record.

Mr. **REID**. That will be the order.

[A biographical sketch of Mr. Burrows follows:]

JAMES H. BURROWS

Biography

James H. Burrows is Director of the Institute for Computer Sciences and Technology, at the National Bureau of Standards. He directs a government-wide program to develop automatic data processing (ADP) standards, provide technical advice and assistance, and carry out research in computer and information technologies. He has held this position since May 1979.

From July 1972 until May 1979, he was the Associate Director of Computer Resources for the U.S. Air Force headquarters. Prior to 1972 he directed the development of large information systems and data management projects for the MITRE Corporation and the MIT Lincoln Laboratory.

Mr. Burrows was a member of the President's Reorganization Project for Federal Data Processing in 1978, and in 1981-82 was the Chairman of the Interagency Committee for ADP, an organization of ADP policy officials representing agencies and departments. He has served on technical review panels sponsored by the National Academy of Sciences and the Office of Technology Assessment. He is currently vice-chair of the Information Systems Standards Board of the American National Standards Institute and is a member of a National Research Council panel to study computer procurement, utilization, and replacement policies of the government.

Mr. Burrows received his M.S. degree in 1952 from the University of Chicago and his B.S. degree in 1949 from the Massachusetts Institute of Technology. He is a member of the IEEE Computer Society, the Association for Computing Machinery, the American Association for the Advancement of Science and the Data Processing Management Association.

STATEMENT OF JAMES H. BURROWS, DIRECTOR, INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY, NATIONAL BUREAU OF STANDARDS

Mr. BURROWS. Thank you, Mr. Chairman.

I am Jim Burrows, Director of the Institute of Computer Sciences and Technology at NBS, and I appreciate this opportunity to address the subcommittee.

During the current year, ICST has an authorized funding of $10 million. The fiscal year 1984 request for ICST is $3 million.

At this level of funding, we would concentrate our research efforts on local area networks, continue to modify and adapt for Federal use standards written by the private sector organizations and monitor developments in the national-international voluntary standards arena. However, as Dr. Ambler noted, the Department is reviewing this area and we will be prepared to brief you on any changes later this spring.

I'll be happy to answer any questions, and I thank you for your interest in our program.

[The prepared statement of Mr. Burrows follows:]

U.S. DEPARTMENT OF COMMERCE

STATEMENT OF JAMES H. BURROWS
DIRECTOR, INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY
NATIONAL BUREAU OF STANDARDS

BEFORE THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
ON AUTHORIZATION OF APPROPRIATIONS FOR FISCAL YEAR 1984

MARCH 22, 1983

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE:

I AM JIM BURROWS, DIRECTOR OF THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY AT NBS, AND I APPRECIATE THIS OPPORTUNITY TO ADDRESS THE SUBCOMMITTEE.

THE PROGRAMS OF THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY (ICST) FOCUS ON THE EFFECTIVE MANAGEMENT AND USE OF COMPUTERS AND INFORMATION TECHNOLOGY. WHILE WE HAVE SPECIFICALLY MANDATED RESPONSIBILITIES TO THE FEDERAL GOVERNMENT, OUR PRODUCTS AND ACTIVITIES HAVE IMPACT FAR BEYOND THAT. BECAUSE COMPUTER AND INFORMATION TECHNOLOGIES ARE VITAL TO IMPROVED PRODUCTIVITY IN ALL LEVELS OF GOVERNMENT AND THE PRIVATE SECTOR AND TO THE POSITION OF THE U.S. COMPUTER INDUSTRY AND ITS USERS IN INTERNATIONAL TRADE, WE ARE PARTICULARLY CONCERNED WITH DISSEMINATING OUR RESULTS AS WIDELY AS POSSIBLE.

ICST'S FEDERALLY-FOCUSED ACTIVITIES ARE AUTHORIZED UNDER THE BROOKS ACT (P.L. 89-306), EXECUTIVE ORDER 11717, AND GUIDANCE AND DIRECTIVES ISSUED BY THE OFFICE OF MANAGEMENT AND BUDGET. UNDER THESE AUTHORITIES , ICST PROVIDES TECHNICAL ADVICE AND ASSISTANCE ON COMPUTERS AND INFORMATION TECHNOLOGY, RECOMMENDS FEDERAL AUTOMATIC DATA PROCESSING STANDARDS, AND CARRIES OUT RESEARCH IN COMPUTERS AND RELATED TECHNOLOGIES.

ICST ALSO, OF COURSE, SHARES THE CONCERNS OF THE NATIONAL BUREAU OF STANDARDS AND THE DEPARTMENT OF COMMERCE. THESE ARE CONCERNS FOR THE HEALTH OF AMERICAN COMMERCE AND INDUSTRY AND FOR SCIENTIFIC AND TECHNICAL EXCELLENCE.

DURING THE CURRENT FISCAL YEAR, ICST HAS AUTHORIZED FUNDING OF $10 MILLION. THE FY1984 REQUEST FOR ICST IS $3 MILLION. AT THIS LEVEL OF FUNDING WE WOULD (1) CONCENTRATE RESEARCH EFFORTS ON LOCAL AREA NETWORKS, (2) CONTINUE TO MODIFY AND ADAPT FOR FEDERAL USE, STANDARDS WRITTEN BY PRIVATE SECTOR ORGANIZATIONS, AND (3) MONITOR DEVELOPMENTS IN NATIONAL AND INTERNATIONAL VOLUNTARY STANDARDS COMMITTEE. HOWEVER, AS DR. AMBLER HAS NOTED THE DEPARTMENT IS REVIEWING THIS AREA AND WILL BE PREPARED TO BRIEF YOU ON ANY CHANGES LATER THIS SPRING.

AS THE COMMITTEE DIRECTED IN ITS REPORT AUTHORIZING FY1983 APPROPRIATIONS FOR NBS, WE ARE CONTINUING TO EMPHASIZE THE DEVELOPMENT OF INTERNATIONAL STANDARDS THAT BENEFIT BOTH COMPUTER USERS AND MANUFACTURERS. AS THE COMMITTEE POINTED OUT, THESE ACTIVITIES ARE VITAL TO PRESERVING THE COMPETITIVE POSITION OF THE U.S. COMPUTER INDUSTRY AND TO PREVENTING BARRIERS TO TRADE. ALSO FOLLOWING YOUR DIRECTION, WE HAVE BEEN ABLE TO STRENGTHEN OUR RESEARCH ACTIVITIES IN SUPPORT OF STANDARDS DEVELOPMENT WITHIN FUNDING AVAILABLE.

IN CARRYING OUT OUR PROGRAMS, WE HAVE BEEN WORKING WITH MANY DIFFERENT GROUPS-- ALL LEVELS OF GOVERNMENT, PRIVATE SECTOR USERS, COMPUTER MANUFACTURERS AND SERVICE PROVIDERS, VOLUNTARY STANDARDS GROUPS, AUDITORS, THE BANKING COMMUNITY, AND THE RESEARCH AND ACADEMIC COMMUNITIES. THROUGH TECHNICAL EXCHANGES WITH THESE NATIONAL AND INTERNATIONAL GROUPS, WE GAIN THE KNOWLEDGE AND EXPERTISE TO ADDRESS THE COMMITTEE'S CONCERNS ABOUT THE BROAD IMPACTS OF COMPUTER AND INFORMATION TECHNOLOGIES. WE SPONSOR SEVERAL MAJOR TECHNICAL CONFERENCES WITH THE COMPUTER PROFESSIONAL SOCIETIES EACH YEAR AND HOLD ABOUT 20 WORKSHOPS WITH USERS AND VENDORS ATTENDING. WE RECENTLY STARTED REGULAR MEETINGS VIA TELECONFERENCING FACILITIES WITH STATE AND LOCAL GOVERNMENTS AND WITH INDUSTRY TO EXPAND OUR TECHNICAL EXCHANGES AT LITTLE ADDITIONAL COST.

OUR PROGRAMS DIFFER FROM THOSE OF THE COMPUTER INDUSTRY AND UNIVERSITIES BECAUSE WE FOCUS ON MEETING CURRENT NEEDS AS PERCEIVED BY USERS. THESE PROGRAMS INCLUDE CAPABILITIES FOR INTERCONNECTING COMPUTERS AND EXCHANGING DATA THROUGH NETWORKS, FOR MANAGING INFORMATION RESOURCES EFFICIENTLY, AND FOR PROTECTING COMPUTERS AND DATA FROM WASTE, FRAUD, AND ABUSE.

IN DEVELOPING STANDARDS AND GUIDELINES, WE ARE CONTINUING TO WORK THROUGH VOLUNTARY STANDARDS GROUPS. ICST STAFF MEMBERS PARTICIPATE IN ABOUT 60 COMMITTEES AND SUBCOMMITTEES OF VOLUNTARY STANDARDS GROUPS, AND THEY CHAIR ABOUT A DOZEN OF THESE GROUPS. BY DOING PRELIMINARY TECHNICAL WORK, AND PREPARING DRAFT REPORTS AND SPECIFICATIONS FOR STANDARDS, WE ARE SUCCESSFULLY ACCELERATING TECHNICAL CONSENSUS. AT THE SAME TIME, WE EXCHANGE TECHNICAL INFORMATION WITH OUR COUNTERPARTS IN OTHER GOVERNMENTS AND ORGANIZATIONS, AND WORK TOWARD AGREEMENTS THAT ARE BENEFICIAL TO OUR NATIONAL INTERESTS.

I WOULD LIKE TO SUMMARIZE BRIEFLY OUR INTERNATIONAL ACTIVITIES. FIRST, WE HAVE SUCCESSFULLY PROVIDED TECHNICAL LEADERSHIP IN THE DEVELOPMENT OF INTERNATIONAL STANDARDS WHICH ARE NEEDED TO INTERCONNECT COMPUTERS, MICROPROCESSORS, AND OFFICE SYSTEMS THROUGH NETWORKS. TODAY MANY SYSTEMS CANNOT BE EASILY LINKED TOGETHER, AND THERE ARE NO EXISTING INDUSTRY STANDARDS FOR THE COMPLEX SOFTWARE THAT IS NEEDED FOR COMPATIBLE INTERCONNECTIONS. EACH PORTION OF A VERY COMPLEX SYSTEM OF SOFTWARE HAS TO BE DESCRIBED SEPARATELY, DEVELOPED, AND THEN IMPLEMENTED AND TESTED. WE HAVE BEEN PROVIDING THE DETAILED DESCRIPTIONS OF PROTOCOL SPECIFICATIONS, THE FIRST OF WHICH HAS BEEN ADOPTED BY THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO) AS A DRAFT INTERNATIONAL STANDARD.

BOTH MANUFACTURERS AND USERS HAVE EXPRESSED INTEREST IN WORKING COOPERATIVELY WITH US IN VOLUNTARY IMPLEMENTATION AND TESTING OF THE PROTOCOLS. MORE THAN 75 GOVERNMENT AND PRIVATE SECTOR ORGANIZATIONS HAVE EXPRESSED INTEREST IN JOINING US IN THE TESTING PROGRAM. RESULTS WILL NOT ONLY LEAD TO BETTER PERFORMANCE OF THE PROTOCOLS, BUT ALSO TO THE DEVELOPMENT OF GOOD TESTING PROCEDURES.

ON THIS PAST FEBRUARY 1 AND 2, REPRESENTATIVES OF 28 LARGE SYSTEM VENDORS MET WITH MY STAFF AT A TECHNICAL WORKSHOP TO DISCUSS IMPLEMENTATION REQUIREMENTS FOR LOCAL AREA NETWORKS. AS A RESULT OF THE TECHNICAL AGREEMENTS REACHED AT THAT MEETING, MANY MANUFACTURERS ARE PLANNING TO DEVELOP LOCAL AREA NETWORK

IMPLEMENTATIONS THAT ARE CONSISTENT WITH THE DRAFT INTERNATIONAL STANDARDS. OUR LABORATORY FACILITIES WILL BE USED BY THE MANUFACTURERS TO TEST THEIR NETWORKS.

DURING THE CURRENT FISCAL YEAR WE WILL CONTINUE TO DEVELOP NETWORK STANDARDS, AND WE EXPECT THAT SEVERAL MORE YEARS WILL BE NEEDED TO COMPLETE THE FULL SET OF STANDARDS REQUIRED FOR OPEN SYSTEMS INTERCONNECTIONS. I WOULD LIKE TO POINT OUT THAT COMPUTER STANDARDS ARE INCREASINGLY BECOMING INTERNATIONAL ISSUES. WITHOUT BROAD AGREEMENT ON HARDWARE AND SOFTWARE SPECIFICATIONS, LARGE MARKETS WILL NOT DEVELOP AND LOW COST OFF-THE-SHELF PRODUCTS WILL NOT BE AVAILABLE TO ALL USERS. MANUFACTURERS WILL HAVE TO DEAL WITH A VARIETY OF COUNTRY AND ORGANIZATION STANDARDS -- A SITUATION THAT CAN CAUSE A BARRIER TO FREE TRADE. TO FACILITATE BROAD ACCEPTANCE OF U.S. PROPOSALS, ICST STAFF MEMBERS HAVE BEEN WORKING WITH ISO, THE EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION, THE CONSULTATIVE COMMITTEE ON INTERNATIONAL TELEGRAPH AND TELEPHONE, AND WITH ICST'S TECHNICAL COUNTERPARTS IN EUROPE. INFORMATION GAINED THROUGH THESE INTERACTIONS IS USED IN ADVISING FEDERAL AGENCIES RESPONSIBLE FOR TELECOMMUNICATIONS AND INFORMATION TECHNOLOGY TRADE POLICIES. WE HAVE BEEN WORKING IN THIS EFFORT WITH THE DEPARTMENT OF STATE, THE U.S. TRADE REPRESENTATIVE, AND THE INTERNATIONAL TRADE ADMINISTRATION OF THE DEPARTMENT OF COMMERCE.

SECOND, WITH RESPECT TO OTHER INTERNATIONAL ACTIVITIES THAT HAVE A POTENTIAL IMPACT ON OUR NATIONAL INTERESTS, I WOULD MENTION THAT ICST WAS AN INVITED PARTICIPANT AND PANEL MEMBER IN THE CONFERENCE ON FIFTH GENERATION COMPUTER SYSTEMS HELD IN JAPAN. WE HAVE BEEN COLLABORATING WITH THE EUROPEAN ECONOMIC COMMISSION IN DEVELOPING 1982 VALIDATION PROCEDURES FOR COMPUTER GRAPHICS

HARDWARE AND SOFTWARE. OUR CONCERN IN THIS ACTIVITY IS TO ENSURE CONSISTENCY IN THE APPROACHES TAKEN TO DEVELOP GRAPHIC STANDARDS IN EUROPE AND THE U.S. ICST STAFF MEMBERS PARTICIPATE IN INTERNATIONAL STANDARDS WRITING GROUPS FOR DATABASE SYSTEMS, COMPUTER GRAPHICS, DATA COMMUNICATIONS, AND MAGNETIC MEDIA. WE ARE THE SECRETARIAT FOR AN ISO GROUP THAT IS DEVELOPING DATA STANDARDS FOR USE IN INTERNATIONAL TRADE. IN ADDITION TO DEVELOPING INTERNATIONAL MAGNETIC MEDIA STANDARDS, WE ALSO DEVELOP STANDARD REFERENCE MATERIALS THAT ARE USED FOR QUALITY CONTROL IN MANUFACTURING AND TESTING THE MEDIA. WE ARE THE ONLY WORLDWIDE SOURCE OF THESE MATERIALS. WE CO-SPONSORED A CONFERENCE ON SOFTWARE ENGINEERING TECHNOLOGY THAT WAS HELD IN JAPAN, AND WE ARE CONTINUING TO GATHER AND SHARE INFORMATION ON JAPANESE SOFTWARE DEVELOPMENT METHODS. WE HAVE BEEN ASKED TO ATTEND AN INTERNATIONAL WORKSHOP, TO BE HELD IN JUNE 1983, ON THE INTRODUCTION AND ESTABLISHMENT OF NETWORK STANDARDS INTO VARIOUS NATIONAL ENVIRONMENTS.

IN RESPONSE TO THE SUBCOMMITTEE'S CONCERN ABOUT RESEARCH TO SUPPORT STANDARDS DEVELOPMENT, WE STARTED SEVERAL NEW ACTIVITIES TO ADDRESS FUTURE USER NEEDS. I HAVE ALREADY MENTIONED THE FACILITIES THAT WE DEVELOPED FOR TESTING AND MEASURING THE PERFORMANCE OF NETWORK PROTOCOLS. COMMERCIAL AND EXPERIMENTAL DATABASE SYSTEMS ARE AVAILABLE TO USERS FOR ANALYZING AND EVALUATING THEIR NEEDS FOR THESE SOFTWARE SYSTEMS. SPEECH INPUT AND OUTPUT MAY BE PROMISING TECHNOLOGIES FOR COMMUNICATING WITH COMPUTERS IN THE FUTURE, AND WE ARE LOOKING AT WAYS TO ASSESS THE PERFORMANCE OF SPEECH DEVICES.

MICROPROCESSORS ARE RAPIDLY CHANGING THE WAY THAT PEOPLE WORK AND WHAT THEY DO. WE BELIEVE THAT ORGANIZATIONS WILL NEED NEW POLICIES FOR ACQUIRING AND

MANAGING THESE USEFUL TOOLS, AS WELL AS HELP IN ANALYZING THEIR REQUIREMENTS AND SELECTING THE RIGHT SYSTEMS TO MEET THEIR NEEDS. WE ARE CURRENTLY ADDRESSING THESE ISSUES, AND PLAN TO PRODUCE GUIDES AND OTHER AIDS FOR USERS. IN A FEW WEEKS WE WILL ANNOUNCE A NEW "CLEARINGHOUSE" FACILITY TO SERVE USERS DIRECTLY. THIS COMPUTER-BASED BULLETIN BOARD WILL LET USERS EXCHANGE INFORMATION WITH EACH OTHER AND WITH ICST STAFF, POST INFORMATION, ASK QUESTIONS, AND GET TIMELY ANSWERS ABOUT MICROPROCESSORS.

TO HELP USERS PLAN FOR NEW TECHNOLOGY WE DEVELOPED A TECHNOLOGY FORECAST WITH THE ASSISTANCE BOTH OF OTHER FEDERAL AGENCIES AND OVER A DOZEN PRIVATE SECTOR EXPERTS. THE FORECAST IS BEING USED BY OMB IN DEVELOPING A FIVE-YEAR PLAN FOR FEDERAL AGENCY COMPUTER USE.

I REPORTED TO THIS SUBCOMMITTEE LAST YEAR ABOUT OUR STUDY OF THE EFFECT ON FEDERAL USERS OF A PROPOSED REVISION TO THE COBOL PROGRAMMING LANGUAGE STANDARD. AT THAT TIME, MANY USERS WERE CONCERNED THAT REVISING THE COBOL STANDARD WOULD MEAN COSTLY CONVERSIONS OF EXISTING SOFTWARE IF EQUIPMENT WERE CHANGED. IN CONDUCTING THE STUDY WE ANALYZED ALMOST 1,000 FEDERAL COBOL PROGRAMS WITH MORE THAN ONE MILLION LINES OF CODE. WE BELIEVE THAT THE PROBLEMS ASSOCIATED WITH CONVERSION WILL BE MINOR FOR MOST FEDERAL AGENCIES AND THE POTENTIAL BENEFITS WILL OUTWEIGH THE ESTIMATED COSTS. THE REVISION SHOULD HELP PROGRAMMERS BY IMPROVING PROGRAMMING TECHNIQUES, REDUCING ERRORS, AND MAKING THE LANGUAGE EASIER TO LEARN. FOLLOWING FINAL REVIEW, WE WILL PROVIDE OUR ANALYSIS TO THE VOLUNTARY ANSI STANDARDS COMMITTEE, X3J4, FOR ITS USE IN COMPLETING THE REVISION.

I WILL BE HAPPY TO ANSWER ANY QUESTIONS, AND I THANK YOU FOR YOUR INTEREST IN ICST'S PROGRAM.

Mr. REID. Thank you.

Mr. Kammer.

Mr. KAMMER. I don't have a statement, sir.

Mr. REID. I have some questions.

You have completed your presentation, have you not, Dr. Ambler?

Dr. AMBLER. Yes, sir, we have.

Mr. REID. All right, I have some questions.

I am very much concerned about the Center for Fire Research and the Center for Building Technology. Dr. Lyons, perhaps putting you on the spot with your superiors, what justification can you give me for eliminating outright the Center for Fire Research?

Let's take them one at a time.

Dr. LYONS. Well, the principal justification was the reduction of the Federal deficit, I think. The Director may wish to amplify on that, but that's the principal driving force.

Mr. REID. And I believe it's quite clear that there is no other public agency or private industry or any sort that will be able to do this work. Is that right?

Dr. LYONS. Well, the indications we've had since the budget was published suggest that there is no ready replacement for the Center.

Mr. REID. Well, let's talk about, rather than "ready" replacement, let's talk about any possibilities that could match the work that you did, for example, on the Hilton fire in Las Vegas. Who could do that?

Dr. LYONS. I don't think there is currently any one place that could do that. There are pieces—the National Fire Protection Association, the Factory Mutual Research Corporation, Underwriters Laboratories—that, together, have a good deal of the applied ability that we have. They don't have the basic research.

Mr. REID. But isn't that one of the problems we have—are a lot of people doing a little bit? And it makes it very difficult to arrive at a conclusion.

Let's take, for example, the film you showed us on the Kansas City disaster. Who could have done that work, other than the interested parties?

That is, the Hyatt people could have hired someone and the plaintiffs' attorneys for the injured people could have hired someone but what credibility would they have had?

Dr. LYONS. Well, Mr. Chairman, it's difficult for me to answer that question directly. I can say, however, that, in most disasters, someone else does it because we investigate very few.

So there are other sources in the private sector. The expertise that we have at the Bureau exists in large extent piecemeal in the private sector. For example, in the Hyatt Regency work, we relied primarily on structural analysis—structural testing—on the one hand and on metalurgical examinations, on the other hand.

The Bureau happens to have all that in one place.

Mr. REID. Dr. Lyons, everyone that was involved in that type of work had been hired by either the people who had been sued or were going to be sued or those people who were doing the suing, is that not right?

Dr. LYONS. That's true.

Mr. **Reid**. The reason this was reported on national news is that the Bureau of Standards provided an unbiased view of a national disaster which that was; is that not right?

Dr. **Lyons**. Presumably, that's why the mayor of Kansas City asked us to come in. Yes, sir.

Mr. **Reid**. And is it not also true that the decision made by an unbiased agency, the Bureau of Standards, led to a rapid settlement of the majority of the law suits involved in this disaster in Kansas City, saving the taxpayers tens of thousands of dollars—hundreds of thousands of dollars in time that would be spent in court and other types of things; is that not right?

Dr. **Lyons**. I know that I think they've all been settled. I'm not sure of the motivations for that.

Mr. **Reid**. And, for example, some of the other disasters like that, where there hasn't been a so-called unbiased witness to come in and say: this is what really happened, those suits have gone on for years; is that not true?

Dr. **Lyons**. Sometimes.

Mr. **Reid**. I have no further questions, although I will just state in brief summary: I'm going to do whatever I can with the subcommittee chairman to see that he does something to reestablish funding for these two things which I feel are so important.

And I would also bet that I'll do whatever I can with at least a couple of friends I have in the Senate to see if they can do something to restore these moneys.

Mr. Brown.

Mr. **Brown**. Dr. Ambler, I seem to recall you made a visit to the Far East a couple of years ago, studying standards organizations and practices; am I correct in this?

Dr. **Ambler**. Yes, sir. Yes, sir, I was in Japan about that time.

Mr. **Brown**. And you wrote a report on your visit?

Dr. **Ambler**. Yes, I did, sir. I always write a trip report when I return from overseas.

Mr. **Brown**. I had the pleasure of reading your report, Dr. Ambler, and I thought it was a pretty good report.

What ever happened to that? Did it get published or anything?

Dr. **Ambler**. Well, no, it didn't get published in the usual meaning of that word. It was widely read, I think, within the Government and Congress and indeed in some places in the private sector.

And I did get quite a number of phone calls about it, expressing appreciation for my having done that written report.

Mr. **Brown**. Well, my purpose in raising the question is just to refresh my memory. I don't know whether we ever got a copy of it here in this committee or not and, if we didn't, I'd like to make it a part of the subcommittee's record at this point, if you have no objection to that.

Dr. **Ambler**. No, not at all, sir. I certainly hope you did get a copy.

Mr. **Brown**. Well, we must have because I read it, but I don't know how.

Mr. **Reid**. You will supply that, then, Doctor?

Dr. **Ambler**. Yes, sir.

[Dr. Ambler's trip report follows:]

UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234
OFFICE OF THE DIRECTOR

SUMMARY FOREIGN TRIP REPORT

E. Ambler.

Edward L. Brady

From: Ernest Ambler
Director

Edward L. Brady
Associate Director for
International Affairs

Locations Visited: Japan -- March 29-April 6, 1980
Korea -- April 7-April 11, 1980
(See Appendix A for details)

Purpose of Trip: Japan - To discuss with Japanese officials the policies of the Japanese Government on research & development programs in support of industry and to visit laboratories where R & D programs related to NBS activities are being carried out.

Korea - To visit the Korea Standards Research Institute, to which NBS has provided technical assistance for several years, to visit representative firms in the rapidly developing technological industry of South Korea, and to discuss with Korean officials governmental policies for scientific and technological development.

Accompanied by: No one

Trip Summary: See Attached Report

Attachments:
(1) Trip Report
(2) Appendix A - Detailed Itinerary
(3) Appendix B - List of Officials Met
in Japan and Korea

JAPAN and KOREA:

Impressions of Technological Industry

and

Governmental Science and Technology Policy

I. Summary Conclusions

This report presents the observations of the NBS Director and Associate Director for International Affairs and the conclusions reached after a two-week tour of Japan and Korea, during which we (the above-mentioned NBS officials) met with numerous Japanese and Korean government officials concerned with science and technology policy and visited laboratories and industrial establishments in the two countries.

We had been prepared to witness substantial economic progress in both Japan and Korea, but what we saw far exceeded our expectations. The coherency of the respective societies, respect for family, and willingness to sacrifice for a better life for future generations, an ability to systematically plan jointly between government and industry with progressive targetting on higher and higher technology products, and a projection of family loyalty and coherency into company or institutional and national goals make Japan and, increasingly, Korea formidable competitors.

With Japan fully underway in its programs in computers (which we deliberately did not request to see) and automation and robotics (some of which we did see), there is a new concern on the part of the Japanese. While their present success is based on having adapted and improved technology developed elsewhere, they believe they have now carried this process as far as possible. Consequently, they are now planning their programs so that they may be the next discoverers or innovators. Japanese officials repeatedly emphasized the need to be "creative" and they are clearly concerned that many of their traditions, which have been their strength up until now, may be a hindrance to their future objectives in that their society does not encourage, indeed actively discourages, the maverick. However, in Dr. Inaba, President of Fujitsu FANUC, we saw an outstanding entrepreneur in the very best classical American tradition.

A major component in the Japanese strategy is the encouragement of more research at universities (we were told) and the development of Tsukuba, the so-called "Science City." Actually, apart from the high energy nuclear physics institute, Tsukuba seems to us far more an engineering and technology city than a science city. They do not seem to be setting out to win Nobel prizes; they are setting out to invent. The emphasis of the institutes is either on industry and the economy or on public works.

We were allowed to see anything we asked to see with the exception of robotics and automation. The Japanese quite unabashedly explained that the more advanced work was classified for commercial reasons. Thus, we saw nothing of the Fujitsu FANUC research laboratories nor the advanced projects in the Mechanical Engineering Laboratory in Tsukuba. Some American visitors have expressed skepticism about the prospects for success of the project "Flexible Manufacturing System Complex Provided with Laser." While they would not show us the work on this project at the Mechanical Engineering Laboratory, on the basis of the success the Japanese have had with, it seems, almost everything they plan, we see no reason to doubt that it will be successful when they reveal it in a few years. The project should not be taken lightly by American engineers and manufacturers.

Korea, while not as advanced as Japan, has made remarkable progress in steel, shipbuilding, automobiles, textiles, and electronics. For a country with only 30% of its land arable and no natural resources, the economic growth since 1968 has been astonishing. With a current annual GNP per capita of close to $1600, and an economic growth rate which has been the highest in the world over the past decade, Korea is already a major economic force in East Asia.

Nor is progress confined to factories and cities; in both Japan and Korea the rural developments, particularly the attractive single family dwellings, were most impressive. We saw no evidence of real poverty.

A final comment on the confidence of both the Japanese and Koreans is appropriate. They remain most polite and hospitable, but in no way give any evidence of a sense of inferiority. They are doing well and they know it, and they intend to continue on the paths already well-defined.

II. Background

The challenge of the technological industry of Japan to that of the United States has been apparent for some time and American observers have published innumerable articles on various aspects of this challenge. Only recently has the rapidly growing industrial capability of Korea also become a challenge, but if the growth continues as it has during the past decade, Korea will shortly become a world power in many industrial areas. Understanding the role of governmental infrastructure institutions, such as national standards bodies and technological R & D laboratories, in these countries is necessary to understand the reasons for their technological success. Such an understanding can also help U.S. governmental institutions, including the National Bureau of Standards, determine how to improve their own services to U.S. industry. Further, Japan has recently completed the move of 43 R & D institutions to its new "Science City," Tsukuba, and several of these institutions have been reported to contain facilities unique in the world which might be shared in cooperative projects to the benefit of both the United States and Japan.

In the case of Korea, the National Bureau of Standards has for several years provided consultation and other technical assistance to the Korea Standards Research Institute, while it grew from a concept on paper to an institution with excellent buildings, first class equipment, and a competent technical staff. The project was funded by Korea through a loan from the U.S. Agency for International Development, and has been considered by AID officials to have been very successful and unusually free of problems.

Therefore, conditions seemed appropriate for the Director of NBS to visit these countries personally to learn about their industrial capabilities, their governmental policies, and the programs and capabilities of their governmental laboratories. On his trip, the Director was accompanied by the NBS Associate Director for International Affairs, who is responsible for over-all coordination and oversight of NBS international interactions.

III. Observations and Conclusions

A. Japan

1. Setting national goals - Much of the economic and industrial success of Japan must be attributed to the Japanese ability to set long term national goals, jointly developed by government and industry, which are uniformly accepted by all elements of society. These goals serve as guidelines for both industrial action and infrastructure development. Basic policies apparently do not change abruptly with changes of administration or of leadership but provide continuing guidance for many years.

2. Faith in science and technology - Japanese people, from top government officials to the individual worker on the plant floor, apparently share a common conviction that the future of their country rests upon progress in science and technology and their industrial applications. This conviction, together with the Japanese ability to plan, has led to the setting of national goals in science and technology and establishment of policies to achieve those goals. A recent summary of policies for the decade of the "80's", prepared by the Ministry of International Trade and Industry (MITI), sets out policy guidelines for many areas of industrial and social progress; a copy of this report is available in the Office of the Associate Director for International Affairs.

3. Implementation of policies - The faith of the Japanese Government, industry, and people in the long range planning process has led them to invest billions of dollars in industrial production facilities which may at first sight seem overly ambitious. Past success, however, has led to present confidence that the pattern can be sustained.

4. Need for Japanese to generate new technology themselves - A common theme in the statements of many Japanese Government officials and industrialists was the assessment that Japanese industry probably has fully exploited the current supply of technology available from the West and that in future Japan must itself generate more basic technology internally. In semiconductor technology, computers, steel, optical equipment, and other areas, the Japanese apparently believe they have already taken over as much of the basic technology as exists. In the future, they claim, they must themselves be the source of new breakthroughs.

5. Conviction that the Japanese are not a "creative" people - The Japanese perception that they must generate new technology themselves is apparently a source of official concern because of an additional perception that the Japanese are not "creative." This statement was heard many times. Japanese officials and businessmen claimed that Japanese engineers and scientists are very skillful at refining and improving products and processes, but that they have not shown an ability to create entirely new lines of products. Several stated that they still have much to learn from the United States, and they hope to continue a policy of close technical cooperation with the United States. It is difficult to determine with certainty whether they really believe this, whether it is due to a national shared modesty, or whether it is due to other reasons. We are inclined to accept it at face value.

6. Investment in new R & D facilities - The conviction that the future of Japan rests with technological industry has led the Government to make large investments in technological infrastructure institutions. The need for new facilities plus the desire to remove some of these facilities from the crowded environs of Tokyo induced the Japanese Government several years ago to decide to develop an entirely new complex of institutions at Tsukuba, about 65 kilometers northeast of Tokyo. The transfer of research institutions to new facilities at Tsukuba has just been completed this year; 43 major R & D facilities are now located in this area, plus a university, lower schools, housing, shops, and other amenities for the staffs of these institutions. The 43 institutions belong to the Agency for Industrial Science and Technology, the Science and Technology Agency, the Ministry of Construction, the Ministry of Education, and other Japanese government ministries.

7. Facilities at Tsukuba, the "Science City" - Judging from the facilities that the NBS team visited at Tsukuba, and from the names and functions of the institutes not visited, Tsukuba is much more of a "Technology City" than a "Science City." Perhaps the High Energy Physics Institute and some of the biological institutes, which were not visited, are concerned with more scientific research, but not those under the aegis of the AIST and the Ministry of Construction. The institutes visited were all of impressive size and versatility, with excellent equipment. However, in almost all cases, the facilities were understaffed by American standards; many more research people could be usefully employed than were actually engaged at this time. The facilities and hardware investment seem to be planned for large future expansion.

The efficiency of the facilities must be further diminished by the reluctance of many members of the institutes' staffs to move their families to Tsukuba. This reluctance apparently does not cause resignations of staff members, but it does result in mid-week separation of fathers from their families, especially at the higher levels of the staff.

8. Labor relations in Japan - On the day of the visit of the NBS group to Caterpillar Mitsubishi, located in the outskirts of Tokyo, the annual swearing-in ceremony for new employees was held. At this ceremony the top management officials of the company meet with the year's group of new employees. Speeches are made; the company song is sung; management and employees bow to each other; and the new employees are sworn in as members of the Caterpillar Mitsubishi family. Each employee is then introduced personally to the top officers of the company. This ceremony is not just a Caterpillar Mitsubishi tradition but is normal throughout the industrial firms of Japan. It is an element of the social pattern that leads to personal identification of employees with the company; its welfare becomes their welfare, and employment usually is for life. The success of the individual is thus coupled to the success of the company. Salary depends upon longevity, not upon job assignment; a sweeper is paid the same salary as a large machine tool operator. Groups of employees who work on a particular product line meet regularly to discuss how they might improve the efficiency of their performance and how they might best insure the quality of their product. Employees are normally consulted before changes are made in production methods and indeed are often consulted on product and plant designs. Almost all employees in Japan belong to unions; an employee joins immediately upon employment. Craft unions such as those found in the United States (e.g. carpenters, pipe fitters, welders, etc.) are not found in Japan;

unions are company unions. Employees remain members until they reach quite high levels of management so negotiations frequently have the tone of discussions among managers. The goal of labor-management negotiations is to enhance the welfare of the company, not specifically the welfare of union members. Although job mobility among production workers seems to be low, with a sweeper perhaps remaining a sweeper for his entire working career, the situation seems to be different for engineering staff. At Seiko, for example, engineers are rotated from one assignment to another in order to give them experience in all aspects of company operations and management.

B. Korea

1. Natural resources of Korea - The economic and industrial development of Korea is perhaps even more remarkable than that of Japan, considering the much more primitive level at which Korea began. Before partition of the country, all industrial development, such as it was, was in the North. Most of the trained people and technical competence were there. South Korea has no oil, practically no coal, and meager mineral resources. Only 38% of its land is arable, but that land is exceedingly productive. The major resource of South Korea was, and is, people, and a social ethic that venerates education and looks upon it as the solution to economic problems. Coupled with respect for education is a willingness on the part of the older generation to make lifelong sacrifices to enable their children to receive an education and improve their lot. The personal characteristics and social attitudes of the Korean people, together with financial, managerial, and administrative support from the United States, have led to the development of a self-sustaining economy in South Korea. In the early days of the U.S. assistance program to Korea, it appeared to many observers that the assistance given by the United States was vanishing into a void, that no visible effect could be seen or was likely to be seen. In hindsight, it appears that a base of technical and managerial competence was being developed and that this base had to reach a certain critical size before self-sustaining economic growth could begin. South Korea is no longer a poor country; it is an "intermediate income" country, and its people show determination to continue to grow. For the past decade, the economic growth of South Korea has averaged 12-14% annually, the highest in the world. In 1969, the GNP per capita for Korea was $190; in 1979, it was close to $1600. The country is already an important economic factor in some types of technological industry; if the economic growth can be sustained for the balance of this century, South Korea will become a significant world economic power.

2. South Korean political stability - At the time of the assassination of President Park Chung Hee last fall, there was great apprehension in the United States and South Korea that the political system might disintegrate. Concern was expressed that the military might take control, that North Korea might seize the opportunity to invade, or that the leadership might break apart into antagonistic factions. Instead, the country remained calm, and the constitutional procedures for presidential succession were followed. A presidential election is scheduled in the near future. This evidence of political maturity and stability has apparently given the people and the leadership of South Korea added confidence that the country has a secure and successful system of government.*

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*Events in South Korea since this section was written indicate that this judgment may have been premature.

Despite the present feeling of self-reliance on the part of the South Korean people, they remain nervous about the intentions of North Korea. Border incidents occur regularly and spies are occasionally found (or so it is claimed). South Korea spends approximately 6% of its GNP for military purposes, about the same fraction as the United States. They say they need the presence of U.S. troops and the economic and political support that the United States gives, and they consider themselves to be the most steadfast, most dependable friend of the United States in the Far East.

3. Economic planning in South Korea - An important feature of South Korea's economic growth has been a succession of five year plans developed by the Economic Planning Board, a ministerial level agency with enormous influence on the development of the country. These plans have provided guidance for industrial development, including the scientific and technological infrastructure of the country. The fifth 5-year plan is in preparation at the present time, to be completed late this year, with an English version available in early 1981.

4. South Korean industrial development - The industrial plants visited by the NBS team - the Hyundai shipbuilding and automobile manufacturing works at Ulsan, the Pohang Steel Works, and the electronics complex at Gumi (viewed only from a distance passing through by car) give evidence of the scale of South Korean thinking and of their ability to implement their plans. The shipbuilding plant is one of the largest in the world; it is capable of building a million ton tanker, although it has not yet done so. The first military ship yet built, a destroyer, was launched on the day of the NBS visit, and six ships of various sizes were under construction in the dry docks.

Two years ago, the production capacity of the Hyundai Motor Works for its Pony passenger automobile was 60,000 units per year; it is now 120,000. Sales have dropped recently and the entire production capacity is not being used at present (the production line stopped at 2 p.m. each day). At the Pohang Steel plant, the initial stage of construction, completed in 1973, brought the plant capacity to 1,300,000 tons per year. The plant was immediately profitable, and a series of planned expansions have brought the present capacity to 8,000,000 tons per year. Plans have been made to expand it further to 12,000,000 tons. At that level, it will be one of the largest steel manufacturing plants in the world, larger than any in the United States.

At the Gumi Industrial Complex, electrical and electronic manufacturing is emphasized. A major expansion of this industrial complex is just beginning.

An area of technology in which South Korea has been especially successful is civil construction. It is said that approximately 100,000 Korean construction workers are now engaged on numerous projects in Middle Eastern countries, particularly Saudi Arabia, Iraq, and even Iran. Most of South Korea's oil is imported from the Middle East, and Korean officials consider it essential to develop close economic relationships with these countries. Nevertheless, the Korean government has indicated full support for the U. S. position toward Iran.

5. Future industrial development of Korea - As in Japan, governmental and industrial leaders with whom the NBS team spoke were convinced that the future of South Korea lies in the expansion of its export markets and technological industry. Government and industry are driving ahead as rapidly

as possible to build up their production capability and their supporting scientific and technological infrastructure.

6. Scientific and technological infrastructure - Concurrently with its industrial development, South Korea has built up its scientific and technological infrastructure. Some of its institutions, such as the Korea Institute for Science and Technology and Korea Advanced Institute of Science, have been successfully operating for several years. The infrastructure development process is continuing and will continue for the foreseeable future. An impressive feature of the infrastructure is the construction of a "Science City" at Dae Duk, approximately 85 miles southeast of Seoul, where plans call for the construction of some two dozen research institutes of which several are already operating. In addition, a branch of the local provincial university, Chung Nam University, is already functioning with a student body of approximately 5,000 students.

A striking characteristic of the technical community of South Korea is the large number of persons who have been educated in the United States. At the Korea Advanced Institute of Science, the President remarked jokingly that they had tried to get 100% of their staff with American educations, but had only managed to obtain about 90%. Many scientific leaders of the institutes were recruited from the several thousand Koreans with technical educations residing in the United States. Undoubtedly more members of this group will return to Korea as they see opportunities in that country for research and personal economic advancement continue to expand. The abilities of the American-trained scientists are excellent -- in some cases, outstanding. Frequently they have been successful university professors and research workers in the United States. On returning to Korea, they remain closely coupled to colleagues in the United States.

7. Korea Standards Research Institute (KSRI) - Four years ago the Korea Standards Research Institute was a concept in the minds of a few people in the Korean government and in AID in Seoul and Washington. Now it is a functioning institution in Dae Duk with several buildings already in service, several hundred items of major equipment already delivered, and a competent technical staff numbering close to 200 people. Calibrations and other services are being provided to the Korean industrial and academic community, and KSRI is regarded as an essential element of the Korean technological infrastructure. Its president, Dr. Zae Quan Kim, points out that KSRI's development owes much to assistance obtained from the National Bureau of Standards and he is eager to continue the close association that has existed over the past several years, despite the termination of the loan agreement with AID under which NBS assistance was provided. KSRI has obtained a loan of $8 million from the Asian Development Bank and expects to be authorized to apply for an additional loan of $21 million when the current loan is exhausted. Dr. Kim is justifiably proud of his institution and was eager to show it to the director of NBS.

8. Self-confidence of the Korean people - Clearly apparent even to a casual observer is the calm self-confidence shown by Korean officials and scientists. Their development plans have been very successful and this success has generated confidence that they know what they are doing and that they can continue doing it. They are exceedingly polite, friendly, and hospitable and seem pleased and proud to have American technical leaders visit their institutions. This feeling of self-confidence applies equally well to the Korea Standards Research Institute. Through association with NBS and work in NBS laboratories, KSRI scientists have found that their technical abilities are comparable to those of the NBS staff, and that their institution is well-

organized, competent, and effective (although considerably smaller in scope than NBS).

IV. Interviews with Japanese Government Officials and Businessmen

A. Ministry of Construction (Vice Minister Shinichiro Asai*) - (Brochure available.)** For several years, NBS staff members have worked closely with the staff of the Ministry of Construction on the U.S./Japan Panel on Wind and Seismic Effects, organized under the U.S./Japan Program on Natural Resources. Having learned that the NBS team had planned to visit Japan, Vice Minister Asai invited the NBS Director to visit him personally and to tour the facilities of his ministry at Tsukuba. He expressed particular interest in the new U.S./Japan cooperative program on earthquake predictions recently activated under the technical guidance of the UNJR Panel on Wind and Seismic Effects, and said that he was looking forward to the next meeting in Tokyo in April 1980.

He pointed out that the Japanese government had a program to invite foreign scholars to work and lecture in Japan for a period of not less than 3 months and enquired whether NBS would like to nominate a candidate to participate in this program. Competition for these scholarships is keen since only 10 are available in the entire Japanese government. If NBS were prepared to pay the expenses of guest workers in Japanese laboratories, there is no limit on the number that could be accomodated. Housing and education for children might be difficult, but Asai believed that suitable arrangements could be worked out if NBS were interested.

A general briefing on the facilities at Tsukuba followed (brochure available). Two principal reasons were given for the construction of the new "science city": (1) To replace old laboratories in Tokyo with new facilities, and (2) to alleviate congestion in Tokyo and provide a good environment for research and the families of research people. Initial construction at Tsukuba, approximately 65 kilometers to the northeast of Tokyo, has now been completed, and the final moves of forty-three research institutions took place in early 1980. Total construction cost for the facilities was approximately $2.5 Billion, with an additional $1.5 Billion for purchase of land and development of parks and other public facilities. Ten to twenty per cent of the laboratory costs (that is, approximately $250 to $500 Million) was spent on the purchase of new experimental equipment. As is customary for most construction projects, the cost of the facility was a great deal higher than the original estimate -- approximately 2½ times as much.

B. Agency for Industrial Science and Technology (Director General Dr. Seiji Ishizaka) - The Agency for Industrial Science and Technology (AIST; brochure available) is the R & D branch of MITI, the Ministry for International Trade and Industry (report available). Its Director-General, Dr. Seiji Ishizaka, a former Science Counselor at the Japanese Embassy in Washington, had invited the NBS Director to visit AIST headquarters and laboratories at Tsukuba during the Director's trip to Japan." AIST operates 16 laboratories, nine of which have been relocated to Tsukuba, including the Mechanical Engineering Laboratory, the Electrotechnical Laboratory, the National Research Laboratory for Chemical Industry, the National Research Laboratory for Metrology, all of which have programs closely related to those of NBS. The mission of AIST also includes industrial standardization. Total staff of AIST numbers 4,000, with 2,600 classified as research workers. The current budget, for the fiscal year beginning April 1, 1980, is approximately 100 Billion Yen, ($400 Million),* an increase from 81 Billion yen ($324 Million) for the 1979 fiscal year.

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*The principal host at each organization visited is identified hereafter in parentheses following the name of the organization.

**In numerous places in the following text, the availability of Japanese-published brochures or reports is indicated in parentheses. This material is on file in the Office of the NBS Associate Director for International Affairs and will be made available to any interested persons.

Figures later obtained from one of the institutes in Tsukuba indicate that the cost of supporting a research worker in the laboratory is approximately $80,000 per year. If this figure is valid for all the laboratories, the operational costs for the 2,600 research workers are only a little more than $200 Million, approximately half the total budget of AIST. Most of the balance is apparently for completion of construction work on new facilities and for a small amount of contract research.

According to Ishizaka, much of the increase in the budget from 1979 to 1980 is allocated to energy research, particularly energy conservation.

Ishizaka pointed out that the design of the new laboratories at Tsukuba owes much to the design of the NBS Gaithersburg laboratory. In the early 1960's, he himself had led a group to NBS to learn about the problems of relocating large institutions. He greatly appreciates the hospitality and assistance given by NBS to him at that time and to AIST officials and researchers ever since.

Ishizaka remarked that he had participated in the discussions with the U. S. group led by Presidential Science Adviser Frank Press last October on possible "non-energy cooperation", and said that he would welcome any suggestions put forward by NBS for possible areas of cooperation in this program. The proposed collaboration between NBS and AIST on resource recovery from municipal waste is considered to be a project within this "non-energy" program. The NBS Director pointed out that he too is interested in promoting cooperation between NBS and AIST. Recycled materials is a new area of responsibility for NBS, and an important program on the development of standards for use of recycled oil is underway. Ishizaka considers that among AIST laboratories, NBS perhaps has most in common with the National Research Laboratory of Metrology and the Electrotechnical Laboratory. He hopes that NBS people will come to Japan to work for a period of several months or more, but he sees obstacles, particularly in arranging suitable housing for NBS people and their families, and in finding suitable schools for their children. These problems can probably be solved, but clearly he anticipated that there might be difficulties.

Ishizaka was aware that several scientists from AIST laboratories have worked for months at NBS and inquired what people at NBS thought of these Japanese scientists. He was assured that Japanese guests are highly regarded as competent researchers, and that they seem to have few difficulties in personal relationships, housing, and schools. Ishizaka then commented that he believed that Japanese scientists are probably not as creative as American scientists — a theme that was to be reiterated over and over again during discussions with Japanese officials. He said that Japan still needs to learn from the United States how to be creative in research. He also believes that Japanese technical leadership is not as effective as that of the United States in identifying and exploring new areas of research. It was pointed out to Ishizaka that in the opinion of most U. S. scientists and engineers, there is no deficiency of creativity in Japan.

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*At the time of the visit to Japan, the exchange rate was approximately 250 yen to the dollar. Four weeks later it was 230 yen to the dollar.

At the present time Japan spends approximately $12 Billion on R & D, of which 28% is funded by the national government and 72% by private industry. Of the 28% funded by government, 26% goes to national laboratories and universities, and only 2% to the private sector. Ishizaka claimed, in fact, that almost all of the applied R & D in Japan was done by the private sector, apparently regarding work in the institutes at Tsukuba as basic in nature, (but by U. S. standards almost all of the work at Tsukuba is applied science or technology). Ishizaka believes that the R & D performance by private industry in Japan has improved in the last decade but that industry must still improve further. When asked what would be his criteria for success in R & D, Ishizaka responded that in the future Japan must think about making original contributions to society and to the world. In the immediate post-war period the goal of Japan was to catch up with the West. That goal has been achieved; Japanese society is now mature and comparable industrially to that of the West. Japan must now be more creative in order to build future industries. It was pointed out to him that Western countries are now examining Japan to find out why Japan has been so successful in the post-war period. Not only is productivity high, but Japanese products are better in some ways than those of the West. The question is asked: Why do government and industry work together so well in Japan, while the situation is so different in the United States? The United States must modify its institutional behavior in some ways, perhaps developing a pattern which is more like that of Japan.

In one of the rather frequent expressions of self-confidence on the part of Japanese officials observed throughout the trip, Ishizaka pointed out that apparently the officials of MITI have been doing the right thing for the past thirty years, leading Japan to its present position of industrial strength. One of the important actions of MITI, he said, was to promote the development of industrial standards and quality control in Japanese manufacturing. The American W. Edwards Deming showed the way, and his teachings have been followed for thirty years. Another important decision of the government was to emphasize education at all levels, thus upgrading the quality of production workers as well as engineers and managers.

Dr. Ishizaka gave us a copy of an English language summary of a document entitled "The Vision of MITI Policies in the 1980's." (Report available) This document was prepared by the Industrial Structure Council, an advisory body which discusses MITI policies and deliberates on future directions; it is composed of representatives of academic institutions, industrial firms, consumer organizations, and labor unions. This document sets the following national goals: building a reputation for trustworthiness; achieving economic security through technological innovation, and maintaining the vitality of society, along with improved quality and comfort of life. To achieve these goals, policies are proposed for economic management, international relationships, overcoming energy problems, developing a technology based nation, improving the quality of life, improving local community life, developing a creative industrial structure, and realizing human potential. This remarkable document lays out a blueprint for governmental, industrial, and individual action that can and probably will, guide the Japanese nation for the next decade. A similar document set the pattern for the 70's and there is no reason to doubt that the current document will have a profound influence.

C. Science and Technology Agency (STA) (Administrative Vice Minister, Mr. Hiroyuki Osawa) - At the headquarters of the Science and Technology Agency (brochure available), an organization attached to the Office of the Prime Minister, the NBS group was met by Vice Minister Hiroyuki Osawa, accompanied by Drs. Nagara and Uchida, two former Science Counselors at the Japanese Embassy in Washington. Later we learned there is an informal club of former Japanese Science Counselors in Washington, consisting of 13 members, including the present president of Tokyo University and Dr. Ishizaka of AIST. Dr. Uchida is now in the patent office while Dr. Nagara has an administrative position concerned with technical personnel in STA.

Research interests of STA emphasize energy (especially nuclear energy), space, materials, and disaster prevention. At Tsukuba, STA activities include a space research and tracking facility, a branch of the National Research Institute for Metals, and the National Center for Disaster Prevention.

Vice Minister Osawa repeated the theme that Japanese scientists lag in creativity and that Japan still had much to learn from the United States. He, too, was assured that we in the United States do not see as much of a gap as they apparently do.

When asked what areas he considers to be of greatest potential for future work and possible breakthroughs, Osawa responded that he saw great opportunities in the life sciences, particularly in molecular biology and genetic engineering, resulting in the development of new products and medicines. He sees the United States as well ahead in basic genetic engineering research and said that the Japanese fermentation industry was strongly interested in cooperation with appropriate U. S. firms.

In discussing Tsukuba, he referred to plans to hold a major science and technology exposition and symposium at Tsukuba in 1985, called Expo '85 (brochure available), in order to demonstrate to Japanese industry and people, and to the rest of the world as well, the success of Tsukuba Science City. A major objective of this exposition is to induce technological industry to locate new laboratories and plants in the area, both to improve coupling with the research institutes there, and to disperse industrial development away from Tokyo.

Continuing the briefing on STA, Mr. Shigemichi Sonoyama, Director General of the STA Planning Bureau, informed us that the Science and Technology Agency had been established in 1957 in order to promote R & D in science and technology. It has three principal roles: (1) to develop policies for promotion of science and technology; (2) to carry out research, with emphasis on energy (especially nuclear energy), space, and selected high technology areas; and (3) to coordinate scientific and technological activities among various government agencies.

According to Sonoyama, many people point out that Japan's growth in the post-war period has been based on technology obtained from other countries, but this is not new; this process began even before the Meiji restoration of the late 19th century. Thus, Japan's modernization for a hundred years has been based on the importation of technology from more industrialized countries. However, now Japan is in a new situation; it has caught up with the West and no longer can draw upon Western technology. Japan must learn how to develop its own new technology and thus to contribute to the world supply upon which all countries depend for their technological growth. Japan is counting upon the institutions at Tsukuba to improve technological creativity and upon the 1985 Science Exposition to attract industry to the area. They hope that Expo '85 will promote understanding of the nature of research and its usefulness to industry among industrial leaders. A governmental decision was made at cabinet level five years ago that the installation of government laboratories at Tsukuba would be considered complete at the stage now reached; no further laboratory construction is now contemplated. Instead, the plan is to encourage private laboratories and industrial institutions to locate in the area.

D. Discussion with Managing Director, Daini Seikosha Co., Ltd. (Dr. Reinosuke Hara) - In a breakfast meeting with Dr. Reinosuke Hara, Managing Director of one of the three major Seiko manufacturing companies, opinions and attitudes of another high level Japanese industrial manager were obtained.

Dr. Hara pointed out that there is actually no company just named Seiko; instead, there are three manufacturing companies each emphasizing different lines of products. His company makes precision instruments, numerical control systems, machine tools, (including very large ones for manufacturing purposes), and a variety of other types of manufacturing equipment. Most of their product line derives from equipment designed to meet internal requirements of other Seiko companies, modified as necessary and converted into commercial products. At the present time, his company sells only within Japan, but they are exploring exporting to the U. S. market and probably will begin exports in a year or two. He has recently hired two engineers from the United States who are experts on electron beam technology.

He repeated the by now familiar theme that Japanese scientists and engineers are not creative; that they can refine, improve, and develop products and processes originating elsewhere, but that they rarely turn up entirely new ideas. The "seeds" for Japanese products come from the United States or Europe, even in the semiconductor and computer industry. Japan is weak in basic research; the social environment is not conducive to the development of geniuses.

Quality control is a subject given high priority in the Seiko companies. All employees, including the President, attend a two-day quality control seminar twice a year. These seminars are put on by the Japan Productivity Center and are available to all manufacturing companies in Japan. The staff of the Japan Productivity Center has access to all companies and can learn about new techniques and procedures in quality control and pass these techniques on to other participants in the seminars. Officials of his company, he says, were startled several years ago when a delegation of automobile manufacturers visited their plant and enquired if they made money. If they were in the automobile industry, they were told, they would go broke. Since then, apparently Seiko has improved its quality control procedures.

Dr. Hara agrees with the conclusions and recommendations of the MITI white paper and policies for the 1980's. He has prepared an English language summary of the paper for publication in a Japanese English language journal.

In Japan as in the United States, nuclear power plant safety and proper handling of radioactive waste are sensitive subjects. However, the Japanese government and people are convinced that nuclear power is essential to the future economic development of Japan, partly because of Japan's almost total dependence on imported sources of energy, and organized opposition to nuclear power is not strong. Hara serves on a Japanese Government committee to review nuclear safety and handling of radioactive substances in the nuclear power program.

In Seiko, as in most Japanese industrial firms, employees are normally hired for life. This system, Hara says, has many advantages but he recognizes that in altered economic circumstances problems could arise. In his company engineers are shifted regularly from one assignment to another in order to give them a variety of experience with both manufacturing operations and administrative practices.

V. Visits to Japanese Industrial Firms

A. Caterpillar Mitsubishi (Managing Director, Mr. James E. DeSpain) -- A special request had been made to visit Caterpillar Mitsubishi (brochures available) because it had been highly recommended by a recent NBS visitor as an example of a Japanese manufacturing firm that made extensive use of numerical control machines. Principal American hosts at Caterpillar Mitsubishi were Mr. James DeSpain, Managing Director, and Mr. Frank J. Zehnder, Director, both of whom had many years of previous experience with the American Caterpillar operation.

Caterpillar Mitsubishi is a 50-50 joint venture established 16 years ago by Caterpillar and Mitsubishi to manufacture Caterpillar earth moving equipment. Caterpillar designs and standards are used and the finished product bears only the name of Caterpillar. The company turns out 7,000 units per year with a market value of $700-$800 Million; it employs 4200 people in production plus another four thousand employees elsewhere in marketing and service. All but the very largest Caterpillar earth moving machines are manufactured in Japan. These products are marketed mostly in Southeast Asia and do not compete in areas of the world where the American Caterpillar Company has its major marketing activities. Mr. DeSpain states that he is confident that Caterpillar's use of the metric system helps sell their products worldwide.

The Caterpillar Mitsubishi Company President, Mr. Makoto Nakano, came to the United States in 1951 to study the manufacture of chemical and textile manufacturing equipment and has been associated with American manufacturing firms ever since. Only 21 Americans are employed in this plant, all in management, but not as line managers. Each American has a Japanese counterpart who is responsible for day to day operating management, but long range operational and policy decisions are made jointly by the combined Japanese and American management. The Board of Directors also consists of half-and-half Japanese-American membership. There was no indication that the Board encountered any problems in agreeing upon important decisions.

The American managers pointed out some basic differences in labor and management practices between the United States and Japan. At Caterpillar Mitsubishi, a worker is hired into the company, not into a specific job. His assignment within the company depends on what job needs to be filled at that particular moment. The worker is hired for life; if his first assignment happens to be as a sweeper, he may continue as a sweeper all of his working life. However, his pay would be the same as that of a skilled workman operating a large machine tool; that is, pay depends on longevity, not on the job assignment. Normally a worker would be hired into the lowest of six levels of pay and in the course of a working lifetime, he could expect to progress slowly upward through these pay levels. This system has many advantages when a company is growing and low paid people are coming in at the bottom to keep the average pay down to a reasonable level. Problems arise when the company employment is steady since the average pay then rises steadily and the cost of production therefore increases.

DeSpain believes that Japanese workers have an edge over American workers in skill, partly because they remain in a particular assignment for a long period of time and their skills can continue to develop. In addition, Japanese have stronger motivation to be good workers. The company becomes their "family" and the future of an individual depends upon the company's future. If the company prospers, the individual prospers and his employment remains secure. If a worker leaves the company, he will suffer because his seniority is not transferred with him; he must start over at the bottom of the pay scale in any new company.

At the professional engineer level, the company tries to hire the best graduates of the "best" schools, (e.g. Tokyo University) not necessarily because the engineer from these schools is better educated, but because the contacts he establishes during school would normally be maintained throughout his working career. The graduates of the "best" schools can expect that their schoolmates will eventually achieve important positions in both government and industrial organizations, and will be helpful if necessary in political and financial matters.

Within the company, training of workers, including managers, continues throughout their careers. Training is not necessarily related to a specific job assignment, but includes all the operations of the company. As do most Japanese companies, Caterpillar Mitsubishi emphasizes training for quality control.

All workers become members of a company union upon joining the company; apparently craft unions are unknown in Japan. An employee remains a member as he progresses up the management chain until he reaches the position of Assistant Division Manager. As a result, only 7% of the managers are non-union. One consequence of this practice is that the union members who participate in negotiations with the company are very knowledgeable about the business, and negotiations take place on the basis of what is best for the company, not what is best for union members. These are considered to be synonymous in Japan.

On the day of the NBS visit, the annual swearing-in ceremony for new employees was being held. This year's group of new employees, 217 in all, met with the President and other top officials of the company. Speeches were made; the company song was sung; employees and managers bowed to each other; and then each employee was introduced individually to the top managers of the company. This swearing-in ceremony is not limited to Mitsubishi; apparently almost all Japanese organizations, whether industrial, commercial, or governmental, have a similar ceremony.

Following the discussion with the American company officers, the NBS team toured the factory. The plant was clean and well ventilated, and all employees seemed to be busily working. This plant uses approximately 2,100 machine tools of all types, some of which are quite large and are equipped with turret heads to carry out multiple machining functions. Many of the machines are equipped with numerical controllers, most of which seem to be made by FANUC. We were informed that during the next three years 350 of these machines were to be replaced by 200 machines of higher productivity, most of which would be equipped with numerical controllers. The level of automation and productivity in this plant were said to be about the same as in a Caterpillar plant in the United States, and the unit cost of manufacturing was said to be comparable.

B. Fujitsu FANUC (President, Dr. Saemon Inaba) - A visit to Fujitsu FANUC (brochure available) had also been requested because of the recommendation of the same NBS staff member who suggested Caterpillar Mitsubishi. This company is reputed to be a world leader in the design and manufacture of numerical control devices. Dr. Saemon Inaba, President of FANUC, personally and solely escorted us through the manufacturing operations of his plant. Dr. Inaba is a most impressive man, cast in the mold of the classical technological entrepreneur. Formerly, he had been manager of numerical controller manufacturing for Fujitsu, when a decision was made to spin off this business and concentrate on computers. With the support of Fujitsu, an independent company was established with Dr. Inaba in charge, funded 47% by Fujitsu. The parentage is perpetuated in the name FANUC, which is derived from Fujitsu Automated Numerical Controllers.

FANUC makes four lines of products; (1) numerical controllers, (2) servo and spindle motors, (3) robots, and (4) numerically controlled machine tool systems. At the present time its output totals 1750 numerical controllers per month. They plan to raise this to 2000 units by October, half of which will be exported, half sold in Japan. Twenty per cent of the 2000 units will be equipped with robots. Three types of robots are now being manufactured, and an additional two types will shortly be put on the market, at least one of which will be equipped with optical sensors.

Among the largest customers for numerical controllers are Pratt and Whitney and Colt in the United States. On the plant floor, we saw Pratt and Whitney machine tools being fitted with FANUC numerical controllers.

FANUC employs a total of 850 persons, only 150 of whom are on the production line. Two hundred engineers are employed in the research laboratory and an additional 150 engineers provide service to customers. Approximately 150 persons are employed in administrative capacities; the balance serve as salesmen and representatives. A short time ago 300 persons were employed on the production line, but half of these had been replaced by 50 robots. Robots were observed in action on several of the production lines, including the line for the production of more robots. The value of the products turned out by the 150 production workers is approximately 2 billion yen per month (about $100 million per year).

The production line workers were graduates of technical high schools, and after only one month's special training at FANUC they were placed on the production line and proved to be satisfactory workmen. FANUC engineers were graduates of an academic engineering curiculum and were given no further training before being put to work on FANUC products.

Dr. Inaba's tour included the entire manufacturing plant but not the "Research Laboratory." When a comment was made that we did not get into this laboratory, Dr. Inaba laughed and said that even the production workers and other employees are not allowed in unless they have a specific need to be there. A special badge is required for entrance. From the description of the work, however, it appeared tha the "research" laboratory was concerned mainly with design and adaptation rather than basic research. One of its developments was FAPT, a FANUC adaptation of the programming language APT. Dr. Inaba seemed thoroughly familiar with the full details of the design and manufacture of his products, so much that he could be a production worker on any of the production lines.

VI. Japanese Government Research Activities

A. National Research Institute for Metals (Director, Dr. Toru Araki) - Established in 1956, the National Research Institute for Metals (brochure available) is a laboratory of the Science and Technology Agency with the mission of providing information on metals and other materials, especially at high temperatures. Its staff numbers 470 persons, 105 of whom have Ph. D. degrees. Ninety per cent of its budget comes from its parent agency, approximately one per cent from industry, and the rest is obtained from MITI and the Environmental Protection Agency.

The management of this laboratory decided several years ago that adequate data were not available on the creep and fatigue behavior of carbon steels at elevated temperatures and an extensive program was established to obtain the desired data. (Report available.) Eleven hundred tensile testing machines have been set up with samples maintained at various temperatures (± 2° C) to measure creep and fatigue in many different steels. Tests are to be run for periods up to 11 years; at present some have run as long as seven years. Current data are published in a series of data sheets as they are obtained. They seemed eager to cooperate with the Standard Reference Data Program at NBS.

A branch of NRIM has been established at Tsukuba (not visited), but the main laboratory facilities will remain in Tokyo.

B. Geographical Survey Institute (Director General Sairo Sasaki) - The Geographical Survey Institute (brochure available), an agency of the Ministry of Construction, is the principal Japanese organization for land survey and mapping. At this institute we were shown equipment for calibration of cameras (report available) used for airborne aerial surveys for map preparation. Camera lenses are checked in this laboratory to determine their modulation transfer function. Another facility is a 110 meter optical table used for calibration of electronic distance measuring equipment, and for calibration of 25 meter invar tapes.

At the time of our visit, Dr. Sakuma of the International Bureau of Weights and Measures, one of the world's foremost authorities on gravity measurement, was installing a commercially made gravimeter (designed by BIPM and made by Jaeger in Paris) to get accurate measurements of the force of gravity in Japan. Results will be compared with those obtained at BIPM by means of a portable gravimeter checked in both Paris and Japan.

C. Building Research Institute (BRI) (Director-General Kiyoshi Nakano) - Members of the staff of the Center for Building Technology of NBS have collaborated for several years with colleagues in the Building Research Institute of the Ministry of Construction, the Science and Technology Agency, and other Japanese organizations, under the program of the US/Japan Panel on Wind and Seismic Effects and several have visited the new facilities of BRI at Tsukuba.

No attempt will be made here to give a comprehensive description of the program of the Building Research Institute (brochure available). It includes technology of building construction, housing and urban planning, energy conservation, earthquake engineering, and other aspects of building technology. BRI is organized into eight departments: (1) housing and building economy, (2) materials, (3) structural engineering, (4) production, (5) environment, design, and fire, (6) urban planning, (7) the International Institute of Seismology and Earthquake Engineering, and (8) testing and evaluation. One hundred eighty people are employed in facilities that apparently could accommodate several times that number. Present budget is about 2 Billion yen per year (about $8 Million).

A major facility at BRI is a massive reaction wall used to study the effect of lateral forces on buildings (report available). A building which may be up to several stories high is erected alongside the reaction wall, and hydraulic jacks between the reaction wall an[illegible]he building then are used to exert lateral forces against the building. [illegible]tresses and strains in the building are measured as a function of the force exerted, and the force is increased until the building is destroyed. During the past 15 months, three buildings have been tested to destruction in this way, one each of four, five, and six stories. Each test costs approximately $1 Million but the construction information gained has already been put to practice in a number of ways and a benefit-to-cost ratio of approximately 100-1 is estimated for these experiments.

Fire research facilities in this institute (report available) include equipment for studying deformation of steel beams in fires, facilities for studying fires in full size furnished rooms, a smoke tunnel, and other special purpose equipment. Twelve people are employed in the fire research group, using facilities which seem to be capable of accomodating many more.

Approximately 10% of the operating budget of the BRI goes into fire research. Capital investment in the fire facility was said to be 3 billion yen (about $12 Million).

D. National Center for Disaster Prevention (Director-General Naruto Ohhira) - The country of Japan is subject to many types of natural phenomena capable of causing enormous disasters to life and property — earthquakes, typhoons, tsunamis, heavy rainfall, fires, and snow. The National Research Center for Disaster Prevention (brochure available) was set up by the Science and Technology Agency to study such disasters and ways of minimizing the damage they can cause.

A major facility of this Center is the largest shaking table in the world, fifteen meters square (brochure available). Structures of various types can be erected on the shaking table and then subjected to motions similar to those experienced in an earthquake. At the present time the table can be actuated in two horizontal dimensions but not vertically. This table, in service since 1970, was built at a cost of about one billion yen (at that time a little less than $3 million).

A large, high shed, mounted on tracks to enable it to be moved laterally, has been equipped with numerous nozzles near the ceiling from which water can be sprayed to simulate heavy rainfalls — over a range of from 15 to 200 millimeters per hour. On the ground underneath this shed, actual rivers and valleys can be modeled, to obtain information about the full-size situations.

E. Public Works Research Institute (Director-General Yoshijiro Sakagami) - The Public Works Research Institute (brochure available) of the Ministry of Construction is one of the largest in Tsukuba in both size and number of people employed. Its facilities occupy a ground area of 134 hectares and cost about $200 Million; its research budget was said to be $16 Million, in addition to salaries. Special facilities in this laboratory include a large testing machine of seven million pound capacity, used for testing steel girders and concrete supports; a small shaking table; and a strong wind test facility (report available). Japan averages 4.4 typhoons per year and a wind tunnel has been built in which winds up to 60 meters per second (approximately 135 miles per hour) can be simulated. An important subject of study in the wind tunnels is the aerodynamic behavior of bridges, of which there are thousands in Japan, but bridge design was said to be so conservative that in actuality, few have failed. Winds up to 140 miles per hour have actually been observed during typhoons.

Another major facility at PWRI is a 400 meter long tunnel (report available) used for studying traffic behavior and reactions of individual drivers while driving through road tunnels. It is also to be used for studying fires in tunnels. Plans have been made to extend the length of the tunnel to 700 meters.

In the Coastal Hydraulics Laboratory, the actual geometry and hydrodynamics of specific areas on the coast of Japan can be modeled (scale factor about 10,000 to 1) and studied. At the time of our visit, a model of the bay at Hiroshima was being studied to determine how to protect low-lying areas of the city of Hiroshima from the action of sea waves (report available).

Another major project of PWRI is the "Dual Mode Bus System." (Brochure available.) This is an electric powered bus for transporting people driven by a human being for that portion of the bus trip which requires frequent starts and stops to pick up people, but driven by a computer-controlled driverless guideway for long distance, non-stop segments of a trip. Such a bus could pick up people in the suburbs, then be driven to a station where it would be turned over to automatic control; then driven several miles into the city to a terminal and once again taken over by a driver. Alternatively, automatic stops could be made at specified terminals to pick up or discharge passengers. The automatic guideway for such a bus could be built, it was said, for $8 Million per kilometer in the Tokyo area, while a four-lane highway for driver controlled passenger traffic costs about $40 million per kilometer. (This corresponds to about $55 Million per mile; for comparison, the Washington subway system will cost about $90 Million per mile when completed.)

F. Electrotechnical Laboratory (Director-General Dr. Tatsuji Nakajima) - The Electrotechnical Laboratory (ETL), one of the oldest of the 16 laboratories now within AIST, was established in 1891, and initially was within the Ministry of Commerce; it was incorporated into AIST upon the establishment of that agency. Its original responsibility for radio engineering and communication technology was later transferred to the Nippon Telephone Company. Power engineering electrical standards, and electrical measurement remain its responsibility, and in recent years as electronics has become increasingly important in the economy of Japan, this type of research has expanded greatly at ETL. Government-sponsored research in semiconductor technology and computers is now one of the major responsibilities of ETL; the first transistorized computer in Japan was constructed at this laboratory. Its present program includes solid state physics, information processing, and some aspects of energy research. (In the later tour of the Electrotechnical Laboratory, we were not shown any of the semi-conductor or computer research; these subjects had been intentionally omitted from the list of interests previously transmitted through the American Embassy.)

ETL is a major participant in the Japanese "Sunshine" project, a large national research program carried on at several laboratories to develop alternative sources of energy (report available). The ETL program emphasizes solar energy, especially photovoltaic work, and also includes work on MHD. In the "Moonlight" project, a national program directed toward energy conservation, ETL work includes studies of superconducting transmission and superconducting magnets. Under the leadership of the Japan Atomic Energy Research Institute, the principal laboratory for fusion research, ETL is involved in plasma diagnostic studies.

A considerable effort is devoted to pattern processing and image recognition by computer. They have developed the ability to recognize katakana and hiragana (Japanese alphabets) characters by optical scanning and computer analysis but are not yet able to recognize kanji (Chinese) characters. Even handwritten katakana and hiragana can be read and a machine is being developed to translate such characters into the appropriate Chinese character. The problem apparently is to determine from the text which of several possible kanji characters might correspond to the particular hiragana or katakana characters that were read. This requires the development of software technology capable of handling the syntax and semantics of the Japanese language.

For the Japanese VLSI program, ETL is developing standards for physical measurement, but questions on ETL activities in this program were not pursued.

In response to an inquiry on the types of measurement standards provided by his laboratory, the ETL Director responded that the Japanese system for traceability is behind that of the United States. Basic standards of various kinds are kept by several separate government laboratories while industry is responsible for development of its own standards. Procedures for systematic checking of industrial standards against national standards maintained by government laboratories were not described. Among standards maintained by ETL are those for voltage, current, and resistance; as is customary, a Josephson junction is used for the voltage standard. ETL also maintains the primary photometric standards.

In its quantum metrology laboratory, in addition to maintaining the Josephson junction standard, ETL is attempting to use SQUIDS to detect the magnetic field from blood flow in the heart and brain. The special design of Josephson junction being used for this purpose was said to well known to Dr. Barry Taylor of NBS.

This laboratory also conducts studies with a Thompson-Lampard capacitor, using a horizontal configuration.

In the acoustics laboratory, two anechoic chambers are used for calibration of standard microphones and other acoustic measurements. The larger of the two chambers has dimensions 9.5 meters x 8 meters x 7.2 meters; the sound absorption cones themselves are 1.9 meters long. Sound energy absorption for frequencies above 40 hertz is greater than 99% and above 200 hertz is greater than 99.9%. This laboratory also contains two reverberation chambers, lined with granite 10 centimeters thick. The smaller of these rooms has a volume of 350 cubic meters, and a "reverberation time" of 30 seconds. The larger room has a volume of 650 cubic meters.

We were also shown ETL's "high β tokamak," now under construction. (β is the ratio of the energy in the plasma to energy in the confining field.) Work on this device is part of the "Sunshine" project under the leadership of JAERI.

G. Mechanical Engineering Laboratory (AIST) (Director Dr. Fujio Honda) - The spacious new quarters of the Mechanical Engineering Laboratory (brochure available) at Tsukuba were occupied in February 1980. Laboratory space was said to be 34,500 square meters (about one-third that of NBS-Gaithersburg). In two of the buildings the structure is designed for a floor loading of 5 tons per square meter, while in other buildings the design floor loading is 3 tons per square meter. Total staff numbers 307 persons, of whom 222 are research workers, and about 1/4 of these have Ph. D. degrees. The budget for fiscal year 1980 is 2.8 Billion yen ($11 Million) of which approximately half was for salaries and the other half was said to be for "research activities."

Projects visited in this laboratory included some robotics research and automated manufacturing systems studies. However, activities shown were not part of their program on the "Flexible Manufacturing System Complex Provided with Laser," which was said to be part of a "national research program" and "not yet at a stage where it can be shown to visitors." Only general information was available, such as is contained in published brochures, on this project, which is to be completed in 1983. Judging from the record of success of the Japanese government and industry in planning and implementing large national projects, we see no reason to doubt that this one will be successful. Achievement of its objectives would give Japanese manufacturing industry significantly increased productivity and flexibility.

Upon completion of the development work for the flexible manufacturing system, a model plant is to built, presumably some time after 1983. More information is to be released at an international symposium to be held in August under the auspices of the Japanese Society for Precise Machinery.

Although we were shown some of the robotics and automated manufacturing projects, (described below) we were not allowed to take pictures of the pattern recognition devices nor of the programmable robots. This was the only Japanese laboratory where we were requested not to take pictures.

A project concerned with improvement in automated manufacturing is a system for detection of a chip on the cutting edge of a milling machine tool. The tool is equipped with a system for measuring the cutting force exerted on the workpiece and to record a signal that measures this force. If the tool chips or breaks, the signal would change abruptly. A system is being developed to detect such a change of signal automatically and to shut down the machine and give a warning of trouble. Another project is the development of a numerically controlled machine (equipped with FANUC controllers) for making surfaces curved in more than one dimension.

A grinding machine is being equipped with sensing devices to regulate the depth and speed of the cut in order to optimize the life of the grinder and the productivity of the machine.

Another project is a computer aided system for design of jigs. A version of the APT computer language called X-APT has been developed for this purpose. At present the objectives are to design the jig by computer and display on a CRT tube what the jig would look like. In a later stage the computer program will be converted automatically into instructions to a numerically controlled machine for production of the jig.

In the robotics laboratory a robot under development is intended to serve as a "guidedog" for blind people (report available). They have concluded that it is more practical to develop a robotic guidedog for blind persons than it is to breed and train several thousand live dogs for the purpose. This robot is called MELDOG, with MEL standing for Mechanical Engineering Laboratory. Two basic functions are incorporated into the operation of this dog: obedience and communication. A third version of this robot, MELDOG Mark III, is now being developed (brochure available).

Another robot, MELARM, consists of two opposed robot arms each with 7 degrees of freedom, computer controlled and programmed by being moved through their required motions manually. This system was designed at the MEL but built outside under contract. Photographs were not permitted.

Photographs were also not permitted of a pattern recognition system under development, although a brochure containing a picture was readily available. In this system an object is viewed from two directions by television cameras; a computer system combines images from both cameras, compares them with standard images in its memory taken from a list of 100 shapes, and then selects the shape which corresponds most closely to the computer pattern. Success in selecting the correct pattern was said to be achieved in almost 95% of the cases.

H. National Research Laboratory of Metrology (AIST) (Director, Dr. Michio Kawata) - The National Research Laboratory for Metrology (brochure available) is the national reference laboratory for physical measurements of many types, including mass, force, length, and other quantities. This laboratory is one of those very recently relocated to Tsukuba from Tokyo.

Laboratories visited included the following:

(a) 300 meter tunnel - This tunnel, 300 meters long by approximately 5 meters square cross section, is used for calibration of optical length measuring equipment and calibration of steel tapes:

(b) Force measuring machine - This device is capable of exerting forces up to 15 meganewtons for calibrating load cells. It has a stroke of 200 millimeters:

(c) X-ray interferometry - This system is similar to that used by Dick Deslattes at NBS but NRLM apparently has had a major problem with vibrations. It was not clear whether the vibration problem was primarily in the Tokyo laboratory or if it was found in Tsukuba as well. The equipment has been set on massive stone blocks to reduce the vibration problem.

(d) Precision balance for kilogram calibration - This balance is designed to eliminate the problems normally experienced with knife edges in a vacuum. Through a special mechanism, weights are changed while the pan is oscillating so that the knife edge is constantly in contact with the beam.

The people in this laboratory apparently feel rather isolated from their colleagues in other institutes at Tsukuba; one person commented that all of their professional colleagues were in other countries, not in their own.

I. National Chemical Laboratory for Industry (AIST) (Director Dr. Hideo Narasaki) - At the National Chemical Laboratory for Industry (brochure available) we were given a brief orientation on the work of the laboratory and an introduction to their computerized data bank program, and we received a request for cooperation in characterizing standard reference materials.

This laboratory has a special interest in preparing polymer standards (PVC) with a narrow molecular weight distribution, and would like to work with NBS on characterizing some research samples that they have prepared. At present this laboratory does not make SRMs for commercial sale and distribution.

A major element of the National Data Bank Program is being undertaken at this laboratory - a project to set up a data bank for various types of spectra: NMR, IR, ESR, mass, and Raman. For the infrared spectra, they plan to remeasure experimentally infrared spectra of selected molecures with a Hitachi spectrometer and digitize the data for storage in a mini-computer. After enough spectra are stored in this way, the spectrum of a unknown compound can be compared through the computer with the already stored spectral data in order to identify the unknown compound. However, the relationship of this project to the national data bank program led by Professor Takehiko Shimanouchi (formerly of Tsukuba University, now deceased) was not at all clear.

I. Stardust Plant (Project Coordinator Mr. Ryuji Yoshino) - "Stardust" (brochure available) is an experimental municipal waste treatment plant in Yokohama, built by the Japanese government to test technologies of waste separation and treatment. Prior to 1965, little attention was given by the national government to the problems of municipal and industrial waste disposal and management. Wastes were generally disposed of by incineration or by dumping on areas suitable for landfills. As pollution problems became serious, and sites suitable for use as landfills became scarce, the federal government began to develop a recycling program.

The Stardust project began in 1973 as an attempt to attempt to recycle municipal waste, recovering the fuel content and reusable materials such as metals and paper. All useful components of the waste are to be recovered and utilized if possible. The first step in the Stardust process is to separate the components of the waste physically; various technologies were investigated for the purpose: low temperature separations, mechanical devices, air streams, and pyrolysis. Following development of the technology, which took three years, a decision was made to build a pilot plant to process 100 tons per day of municipal waste in order to demonstrate the feasibility of the system.

Mixed waste is brought in by truck in the usual fashion and dumped into a large hopper from which it is transported to a separator. From the mechanical separator come streams of paper, garbage, plastic, glass, aluminum, and other metals. The paper is recycled; garbage is composted to produce fertilizer; plastics are reprocessed or burned; aluminum is reprocessed; glass is dumped on a land fill. Mr. Yoshino said that he had seen some recycling work underway at NBS and would like to discuss this further with people from our laboratories. Mr. Yoshino avoided answering questions about the economics of the process, stating that it was not possible from a 100 ton per day plant to get reasonable cost data; a plant of at least 1000 tons per day would be needed. Operating costs of the present Stardust plant are high, but he believes that the net cost for handling a ton of waste, taking into account the sale of the products, will be less than that associated with incineration, accompanied by electricity generation. To construct such plants, municipalities may borrow money from the central government at interest rates of 6½ to 8½%, much lower than commercial rates. At present disposal of waste by incinerator costs 6000-7000 yen per ton (approximately $24-$28 per ton). Target costs for disposal through a Stardust type system is 3000-4000 yen per ton ($12 to $16 per ton). The capital investment in the present Stardust plant is approximately 18 Billion yen ($72 Million).

Before building a 1000 ton per day pilot plant, they plan to obtain more experience in the recovery of the energy content of the waste. Construction of an energy conversion plant will begin this year; the 1000 ton plant is not yet being designed.

The commercial prospects of the Stardust system will be difficult to evaluate in the near future. Although the central government does not have authority to require local governments to adopt the system, some will undoubtedly adopt one or more of the subsystems in the plant; already some are beginning composting.

Feasibility studies are underway and some local governments are expected to adopt at least parts of the system in the near future. The Central government will operate the plant only until the Fall of this year and then lease it to the city of Yokohama if the local authorities wish to continue its operation.

VII. Korea

For several years, the National Bureau of Standards has maintained a close relationship with the Korea Standards Research Institute, beginning even before the concept of such an organization was clearly defined. The mission of this institute is partially derived from Korean studies of U. S. infrastructure institutions. Partial funding to initiate KSRI was obtained through a loan from the U. S. Agency for International Development, which then requested NBS to provide technical assistance to insure that KSRI had the best possible start in developing technical competences needed by Korean science, technology, and industry. Approximately fifty Korean scientists have spent periods of from two weeks to two years at NBS; advice was given on the structure and facilities of the buildings; specifications for major pieces of equipment were reviewed by NBS specialists; and NBS experts have traveled to Korea to give advice on special topics. The President of KSRI issued a special invitation to the NBS Director to visit this institution at any time, and now that KSRI is an operating institution providing services to customers in Korea, the time seemed appropriate for the Director to examine this institution personally and to learn how it had benefitted from NBS cooperation.

Another reason for the Director's visit was the opportunity to observe first hand the remarkable technological growth of South Korea. The economic growth rate of Korea in the past decade has been the highest in the world and the country has already become an important producer of certain technological products -- electronic appliances and devices, ships, automobiles, steel, and other heavy industrial goods. Thus, one purpose of the trip was to observe representative examples of Korean industry and to learn about government policies and programs that have contributed to technological development, as well as to get acquainted with some of the infrastructure institutions.

VIII. Discussions with Korean Officials

A. Korea Advanced Institute of Science (President Dr. Soon Tak Cho) - The Korea Advanced Institute of Science (KAIS) is intended to be the premier Korean institute for advanced training in science and technology. Financial assistance was provided by AID and close relationships have been maintained with a number of American universities and other institutes. At the present time the institute has approximately 900 students, 700 of whom are working for a Master's Degree, while 200 are working for a Ph. D. The Master's Degree normally takes two years, with an additional three years required for the Ph. D. A large majority of the staff of 80 faculty members was educated in the United States.

Graduates of KAIS are in great demand and receive top salaries in industry. Industrial salaries for engineers and scientists in Korea are comparable to those in the United States; an engineer with a few years of experience will receive the order of $30,000 per year. Salaries at the Institute are lower, with a top of about $20,000. This makes it difficult to retain highly qualified staff members.

A second campus for KAIS is planned for the Dae Duk science town location. This facility is to be planned for a student body of 2,000, with a faculty of 500.

The present KAIS facilities were equipped with the assistance of a loan of $4 million from AID; since the laboratory is adjacent to the campus of the Korean Institute for Science and Technology, faculty and students at KAIS sometimes use KIST equipment. An additional loan of $12 million was recently obtained from the Eximbank primarily for equipment purchase.

B. Korea Institute for Science and Technology (Dr. Hyung Sup Choi) - KIST is one of the earliest and most successful of the new institutes of Korea. Its original function was to carry out scientific and technological R & D projects primarily for industrial firms, which did not have their own research laboratories. For the past ten years, service to industry has been emphasized and most of the projects undertaken by KIST had their origins in industrial requirements. However, industry is now encouraged by the national government to develop its own research capabilities, so the emphasis of KIST is shifting to projects that require multidisciplinary capabilities. At present, all of KIST is on the one site in Seoul but a branch will probably be established in Dae Duk, the Korean "Science City" about 90 miles south of Seoul.

On exhibit in a special room were a number of products developed at KIST. These included the following: (a) black and white photographic film now made and sold in Korea, (b) silicon single crystals, (c) several pharmaceutical products including an anti-tuberculosis drug, (d) purified enzymes, (e) "Green Carpet" to improve the physical properties of soils, (f) synthetic fiber for wigs, (g) nickel cadmium batteries, (h) ginseng concentrate, (i) synthetic feed for silkworms to substitute for the mulberry leaves which are the natural food of silkworms; this makes it possible to grow worms in the winter and reduces the seasonal nature of silk processing, and, (j) polyester film.

Another project illustrates a different type of economic benefit derived from KIST work. A Korean firm wanted to begin manufacture of a speciality silicon steel and began to negotiate a license from a firm in another country, which requested $15 million as a fee for its technology. At that point, KIST began to develop a process for manufacturing this type of steel and in a short time published an article on its work. The foreign firm then lowered its price to $3 million, apparently figuring that Korea would soon have an alternative and would not need to make a deal. In a number of other areas, KIST has undertaken projects to learn enough so that they can help Korean entrepreneurs with problems that might develop in their operations.

Our principal host at KIST was Dr. Hyung Sup Choi, who is at present President of the Korea Science and Engineering Foundation (KOSEF) and also an individual scientist doing research at KIST on tungsten and titanium ores from Korean sources. Dr. Choi served as Minister of Science and Technology for approximately ten years and was responsible for guiding the development of KIST, KAIS, and other major institutions of the scientific infrastructure of Korea. He is given great credit for his foresight and leadership. His present organization, KOSEF, is similar to the U. S. National Science Foundation; it has no laboratories of its own but supports R & D work by giving grants and contracts primarily to university scientists. Dr. Choi is also President of the Board of Trustees of KSRI, replacing Dr. Park, former President of the Gold Star Company, who was killed in an automobile accident last year.

C. Ministry of Construction (Minister Dr. Jong Wan Choi) - Dr. Jong Wan Choi, presently Minister of Construction, was the first Administrator of the Industrial Advancement Administration (IAA) when it was established about five years ago. He was an influential supporter of the Korea Standards Research Institute, and was a major participant in the negotiation of the Memorandum of Understanding between the National Bureau of Standards and the IAA, under which support for KSRI was provided. For about a year and a half immediately prior to becoming Minister of Construction, he had been Minister of Science and Technology. His most recent trip to the United States, he said, was to be a participant at the NBS Symposium on the "Technological Knowledge Base for Industrializing Countries" held at NBS in October 1978, but he hoped to visit again soon.

The Ministry of Construction has responsibility for funding and supervising most of the major construction projects in the country of Korea, including urban housing projects, roads, multiple purpose dams, industrial complexes, and other projects. Korea has a major dam construction program, to provide water for irrigation, recreation, human consumption, and industry. Total rainfall in Korea is 60-70 centimeters per year, but most comes during a short period in the summer. One result is that the ratio of maximum flow to minimum flow in Korean rivers is as high as 400-1, rather than the 4-1 which is normal for most U. S. rivers; hence, maintaining uniform supplies of water throughout the year is a major problem.

The Ministry of Construction does not operate laboratories, and Dr. Choi commented that he would very much like to visit the Center for Building Technology at NBS during his next visit to the United States.

D. Ministry of Science and Technology (Dr. Chwa Kyung Sung) - Dr. Sung, Minister of Science and Technology, assumed his present position a few months ago, following the transfer of Dr. Jong Wan Choi to the Ministry of Construction. He had formerly been Director of the Korean Research Institute for Chemical Technology at Dae Duk.

Dr. Sung explained that the responsibilities of his Ministry included policy development, coordination among government agencies, technical cooperation with other countries, scientific and technical information, and atomic energy development and safety (which comprise half the program of MOST).

Thus, MOST has general supervisory responsibilities for KIST, KAIS, the Atomic Energy Research Institute (KAERI), Nuclear Fuel Development, Korea Scientific and Technical Information Center (KORSTIC), and Korea Scientific and Engineering Foundation (KOSEF). Most of the operating funds for these organizations are supplied by the government.

Total scientific and engineering manpower in Korea numbers approximately 800,000 persons, including technicians. Of these, approximately 250,000 would be considered to be scientists and engineers.

Minister Sung says that it is generally agreed that science and technology are important for the future of Korea, but he believes that support given by the government is not commensurate with its importance. A recent budget proposal of MOST was recently cut by nearly 50%; nevertheless, there was still an increase over the previous year. His Ministry recommends that approximately 2% of Korean GNP go into R & D; the present figure is about 1%. (The military budget of South Korea consumes approximately 6% of the GNP.)

MOST is responsible for the development of the science and technology component of each of the five year development plans. The current five year plan ends next year, 1981, and a fifth five year plan is in preparation under the supervision of the Economic Planning Board (EPB). The S & T part of this plan is expected to completed by fall of this year and an English version will be available in early 1981.

IX. Discussions with Embassy Officials

Ambassador William H. Gleysteen gave the NBS group a broad overview of the economic development of the entire East Asia region. He pointed out that South Korea had enjoyed an annual average growth of greater than 10% for approximately two decades, but that in the past two years, the rate of growth had dropped significantly. In 1978, the growth was 14.7%; in 1979, a little less than 10%; and in 1980 he expected that it would be about 5%. By comparison, for the past decade, Taiwan has grown at the rate of 8-9% and Japan at a rate of 5-6%. Growth rate for the entire East Asia region has been around 5% and the prospects for this region look good for the next decade.

The people of the region are well educated and hard working, and each country enjoys a rather homogeneous population. The desire for education seems to be universal and people are prepared to make great sacrifices for their children. The society is achievement-oriented, and there is no resistance to planning; on the contrary, government and industry tend to cooperate naturally. Planning somehow becomes a nice blend of central direction and individual action.

However, there are exceptions to the general rule of rapid economic development, for example, Indonesia. This country has abundant natural resources, but its people do not form a coherent society nor do they have an effective beaurocracy. China is another country that has not shared in the general economic growth although they seem determined at the moment to become more developed.

North Korea, also a communist country, is more prosperous than China, but much less affluent than South Korea. It has a good technological infrastructure, but has a large and rigid bureacracy with little encouragement for individual initiative. With a population of 17 million people, North Korea maintains a military establishment of 700,000 persons.

Mr. William Paupe, the AID representative, pointed out that AID is given much credit for contributing to the economic development of Korea, but that many projects sponsored by AID which have promoted the industrial development and technical infrastructure of Korea would not fit within the present guidelines for AID activities. These guidelines emphasize contributions to basic human needs, such as agriculture, housing, education, and health. The path that led to success in Korea could not now be followed.

Mr. Paupe also commented that the cooperative project between NBS and KSRI had been quite successful and unusually free from problems.

X. Industry in Korea

A. Hyundai Group (Mr. C. S. Han) - The Hyundai group is the largest industrial organization in Korea, with 1978 sales of $3.7 billion per year. It ranks 78th on the 1979 Fortune 500 list of largest industrial firms outside the United States, rising from 98th the previous year. Two parts of this company were visited -- the shipyards and the automobile manufacturing plant. Construction of the shipyards was completed in 1972 and the first ships were delivered in June of 1974 -- two tankers of 260,000 tons each, with a construction time of 15 months. Since these original ships were delivered, a total of 120 smaller ships have been built. The dry dock has the capacity to handle tankers up to one million ton capacity, but none of this size has yet been produced. At the time of our visit, six ships were under construction in the two dry docks, in which twenty to thirty ships of various sizes can be produced each year. The first military ship, a destroyer, was being launched that day in ceremonies attended by the President of Korea.

Because all of the Hyundai officials concerned with the shipbuilding plant were participating in the destroyer launching ceremony, Mr. C. S. Han of the Nuclear Power Division was our guide for the tour. He pointed out that there are three divisions within Hyundai Heavy Industries, which itself is only one of several components of the Hyundai Group -- shipbuilding, industrial plant design and construction, and nuclear power. For nuclear power plants, Hyundai builds the stationary parts of the turbines, heat exchangers, condensers, piping, storage tanks, steam generators, and pressurizers. Next year they will have the capability to make pressure vessels for nuclear cores. Under an agreement with Westinghouse, much of the technology has been obtained from that firm. Korea has one of the most ambitious nuclear power programs in the world, with plans to build approximately 80 plants by the end of this century. This averages out to one nuclear power plant put on stream every three months for the next twenty years. The first four power plants are already under construction; Hyundai will be involved in the construction of the next four. After the first four, ninety per cent or more of each power plant will be made in Korea.

Although Mr. Han is with the Nuclear Power Division, he seemed to be thoroughly familiar with shipbuilding. In the shipbuilding division, many types of ships can be constructed, including LNG carriers, container ships, oil tankers, general cargo ships, and "Ro-Ro" ships, (roll on-roll off).

In a brief tour through the plate forming and welding shop, we observed sheet metal approximately 3/4 inch in thickness being cut to the proper shape, bent around curved templates, and welded into subassemblies. Much of the bending was done by heating with hand torches and hammering. Looking at the great variety of sizes and shapes of individual sections, a person with an untrained eye would have to wonder how it was possible to fit all of the pieces together and make a ship. Two cranes each of 450 ton capacity were available so the maximum mass that could be handled was 900 tons. This full capacity is not needed for smaller ships. There was no visible evidence that computers were being used for design or inventory control but it would be surprising if they were not.

The Hyundai Motor Company was founded in 1967 as a result of a government policy decision that Korea should have an automobile industry. For several years, Hyundai was an assembly plant only, assembling Ford Cortinas under a licensing agreement. At the present time, Hyundai produces twenty different types of motor vehicles. In the plant at Ulsan, built in 1975 with automobile manufacture beginning in 1976, ten thousand workers produce a broad range of products. Ford Cortinas are still made but the major passenger vehicle is the Pony, with a body designed by an Italian designer. Both diesel and gasoline engines were being manufactured in this plant. The Pony production line is capable of producing 120,000 units per year, but at this time it is not being used to full capacity because of a slump in sales. The line, in fact, was shut down at 2:00 p.m. each day and the employees were all given extra training assignments for the balance of their shift.

The first evidence of services being provided by KSRI to Korean industry was observed in the quality control laboratory of this plant. Many of the instruments and gage blocks in this laboratory bore a little sticker indicating they have been calibrated by KSRI.

B. Pohang Steel Works

The Pohang Steel Company, a government owned organization incorporated in 1968 by the Ministry of Industry, is an illustration of a government policy decision being put into practice efficiently and profitably. Construction of the plant began in 1970 and by 1973 an integrated plant capable of producing 1.3 million tons of steel per year was on stream. In 1976 and 1978, second and third stages were completed, bringing the capacity up to 5 million tons per year. The present stage of construction, now underway and expected to be completed within a year, will bring the capacity to 8.5 million tons per year. Raw materials for steel manufacture are not found in Korea; iron ore is imported from Australia, India, New Zealand, and Brazil; coal comes from Australia, the United States, and other countries. Despite this necessity to import raw materials, the plant was immediately profitable and continues to be so profitable that further expansion is planned, as well as the construction of an entirely new plant on the west coast of Korea. The fifth stage of expansion at Pohang will bring its total capacity to about 12 million tons per year, larger than any single integrated plant in the United States.

In a brief tour of the plant, we were shown the blast furnaces (the basic oxygen furnace process is used throughout); the control room for furnace operations (equipped with DEC computers made in the United States but incorporated into a system put together in Japan); slag dumps (slag is used for cement manufacture, fertilizer, road gravel, etc.); and the rolling mill (slabs of red hot steel are converted into rolled up coils of sheet steel).

This plant demonstrates that a central government organization has the technical and managerial capability to design, build, and operate successfully an enormous, technological industrial plant — something that cannot be said of all central governments.

C. Gumi Industrial Complex

The Gumi Industrial Complex is a group of several dozen private plants emphasizing electronics and light manufacturing located at an industrial park alongside the main highway from Seoul to Pusan. Administrative services and other assistance are provided by the government. A quick drive through was taken to gain a general impression of its size and diversity. This complex is now being expanded onto a new site adjacent to the existing one; the first building on the new site, appropriately enough, is a semiconductor research institute.

XI. Korea Standards Research Institute - With its laboratories at Dae Duk science city and a branch office in Seoul, the Korea Standards Research Institute (KSRI) is still growing, providing a variety of services to industrial customers throughout Korea. Upon the termination and complete expenditure of the $5 million loan obtained from the U. S. Agency for International Development used to begin the development of the Institute, an additional loan of $8 million was obtained from the Asian Development Bank for equipment procurement and further development. A proposal is under consideration for still another loan, also from the Asian Development Bank, for about $21 million for further expansion. The staff numbers about 200 persons, many of whom have been educated in the United States, and nearly 50 have spent weeks or months at the National Bureau of Standards for orientation and training. A brochure and other information describing KSRI are available in the Office of the Associate Director for International Affairs.

KSRI officials took advantage of the presence of the Director of NBS to hold two ceremonies featuring items obtained from the National Bureau of Standards. The first ceremony was the formal dedication of a 100 ton deadweight testing machine to be used for force calibrations in Korea. Long owned by NBS and replaced by more modern equipment, this machine had been declared surplus and transferred to Korea under special arrangements with AID. Despite problems during transport and installation that will require eventual recalibration of the machine and its weights, the machine is operable, at least over a limited range, and can be used for certain purposes.

The second ceremony was the official planting of a cutting from the "Newton Apple Tree" at NBS which had been previously sent to Korea and temporarily planted to determine whether it would grow properly. The Director of NBS and the President of KSRI spoke on the symbolic aspects of the occasion, signifying both the continuity and unity of science and the close kinship of their two institutions. Many local provincial and industrial officials and a large number of school children from the area were in attendance. The ceremony was particularly appropriate because the day happened to be Arbor Day, a day on which school children all over the country plant trees to help reforest the formerly almost bare hills and valleys of the country, denuded by the demands of the people for fuel. Recognizing the importance of reforestation, the Government instituted Arbor Day as a means both of impressing upon the public the importance of trees and of planting new trees to replace those that have been removed. Television reporters covered the Newton Apple Tree planting and reports appeared on the evening news in Seoul.

While at KSRI, the Director presented a talk on the National Bureau of Standards, describing its facilities and main features of its organizational structure and giving examples of NBS programs to illustrate the wide range of science and technology covered by NBS work. The lecture was attended by almost all of the professional staff of KSRI.

The Agreement for Cooperation between NBS and KSRI calls for the Director of NBS to be an Honorary Member of the Board of Trustees, a group of industrial and governmental officials which sets policies and operating guidelines for the development of the institution. Meetings of the Board are held twice a year and a special meeting was held to take advantage of the presence in Korea of the NBS Director. Chairman of the Board is Dr. Hyung Sup Choi, former Minister of Science and Technology, now President of KOSEF. Brief excerpts from the discussions were translated for us by Mr. C. O. Kim, the resident representative of KSRI at NBS, who had gone to Korea for the Director's trip. Several of the Board members made statements indicating that they understood the mission at KSRI quite well and supported the institution strongly. The Director of NBS was requested to give his reactions to what he had seen of the institute during the previous day. He pointed out that what he had seen and heard of KSRI indicated that it is a fine institution and he congratulated the President and the Board on their accomplishments. Facilities were excellent and the staff was competent. He emphasized the importance of KSRI remaining in close contact with industry and its other customers. It was now necessary for the institution to begin to realize the objectives for which it was created. He was proud of the role that NBS had played in the development of KSRI and he looked forward to a close cooperation for many years.

Appendix A

ITINERARY

March 29, Saturday	Arrive Tokyo Airport
March 31, Monday	Ministry of Construction headquarters Agency of Industrial Science and Technology headquarters Science and Technology Agency headquarters National Research Institute for Metals, Tokyo laboratory
April 1, Tuesday	Caterpillar Mitsubishi plant Fujitsu FANUC
April 2, Wednesday	Travel to Tsukuba Geographical Survey Institute Building Research Institute National Center for Disaster Prevention Public Works Research Institute
April 3, Thursday	Tsukuba Electrotechnical Laboratory Mechanical Engineering Laboratory National Research Laboratory of Metrology National Chemical Laboratory for Industry Travel to Tokyo
April 4, Friday	Stardust plant, Yokohama Working lunch with AIST Director
April 6, Sunday	Travel to Seoul
April 7, Monday	Seoul, Korea Korea Advanced Institute of Science Korea Institute of Science and Technology American Embassy
April 8, Tuesday	Seoul to Ulsan to Pohang to Kyungju Hyundai Shipyard (Ulsan, Korea) Hyundai Motor Company (Ulsan) Pohang Steel Company (Pohang) Drive to Kyungju
April 9, Wednesday	Drive Kyungju to Dae Duk Korea Standards Research Institute Korea Research Institute for Chemical Technology Korea Institute for Ship
April 10, Thursday	Dae Duk to Seoul Ministry of Construction Ministry of Science and Technology KSRI Board of Trustees meeting
April 11, Friday	Seoul to Washington, D.C.

Appendix B

OFFICIALS MET IN JAPAN AND KOREA

JAPAN

Ministry of Construction:

Mr. Shinichiro Asai, Vice Minister for Engineering
Mr. Hiroaki Tamamitsu, Director, International Affairs Division, Planning Bureau
Mr. Yoshijiro Sakagami, Director-General, Public Works Research Institute
Dr. Tadayoshi Okubo, Deputy Director-General, Public Works Research Institute
Mr. Ryuichi Iida, Director, Planning Department, Public Works Research Institute
Mr. Seiji Nakano, Director-General, Building Research Institute
Mr. Katsuro Kamimura, Assistant Director-General, Building Research Institute
Mr. Sairo Sasaki, Director-General, Geographical Survey Institute
Mr. Keiji Nishimura, Councellor, Geographical Survey Institute
Mr. Tetsuo Numaoi, Overseas Cooperation Officer, International Affairs Division, Planning Bureau
Mr. Itam Kawakami, Building Planning Section, Government Building Department
Dr. Akira Ishido, Assistant Director-General, Public Works Research Institute

Agency of Industrial Science and Technology:

Dr. Seiichi Ishizaka, Director-General
Mr. Kanji Hosaka, Director-General of the General Coordination Department
Mr. Katsuyuki Matsumura, Director-General, Standards Department
Mr. Katsuo Fujimoto, Counsellor for Technological Affairs
Mr. Yusuke Haraki, Director, Research Administration Division
Mr. Ryuji Yoshino, Director for Development Program (Resources Recovery)
Mr. Koichi Yamaura, Director, Office of International Research and Development Cooperation
Ms. Ayako Kuwahara, Senior Researcher, Office of International Research and Development Cooperation
Dr. Hideo Narasaki, Director, National Chemical Laboratory for Industry
Dr. Fujio Honda, Director, Mechanical Engineering Laboratory
Mr. Tatsuji Nakajima, Director, Electrotechnical Laboratory
Mr. Michio Kawata, Director, National Research Laboratory for Metrology
Mr. Hosaka, Director-General, General Coordination Department
Mr. Haraki, Director for Research Administration Division
Mr. Yamaura, Director for Office of International Research and Development Cooperation
Mr. Oota, Director for International Standards Office
Dr. Makoto Kimura, Deputy Director-General, Mechanical Engineering Laboratory
Mr. Minoru Abe, Director, Research Planning Office, Mechanical Engineering Laboratory
Mr. Makoto Okyama, Counsellor of Technological Affairs
Mr. Dairokuro Yashiro, Chief, International Liaison Office, National Chemical Laboratory for Industry

Mr. Kensaku Nishiya, International Relations, Electrotechnical Laboratory
Dr. Michio Kawata, Director, National Research Laboratory of Metrology
Dr. Etsuo Fujie, Director, Analytical Chemistry Division, National Chemical Laboratory for Industry

Science and Technology Agency:

The Honorable Hiroyuki Ozawa, Administrative Vice-Minister
Mr. Shigemichi Sonoyama, Director-General, Planning Bureau
Mr. Hikaru Hayashi, Director, International Affairs Division, Promotion Bureau
Mr. Naruto Ohira, Director, National Research Center for Disaster Prevention
Dr. Toru Araki, Director General, National Research Institute for Metals (also President, Iron and Steel Institute of Japan)
Dr. Kazuo Tsuya, Deputy Director General, National Research Institute for Metals
Dr. Masatoshi Suzuki, Director, Corrosion Division, National Research Institute for Metals
Dr. Masao Kanao, Director, Fatigue Testing Division, National Research Institute for Metals
Dr. Renpei Yoda, Director, Creep Testing Division, National Research Institute for Metals

Caterpillar Mitsubishi:

Mr. Makoto Nakano, President
Mr. J. E. Despain, Managing Director
Mr. Saburobee Inoue, Managing Director
Mr. Frank J. Zehnder, Director
Mr. Yoji Otokozawa, Overseas Business Division, Direct Sales and Overseas Coordination Department

Fujitsu FANUC Ltd.:

Dr. Eng. Saemon Inaba, President

Daini Seikosha Co., Ltd.:

Dr. Reinosuke Hara, Managing Director

Ebara Corporation (Contractor to AIST for Stardust pilot plant):

Mr. Muneo Saeki, Construction and Plant Manager, Stardust

Japan External Trade Organization (JETRO):

Mr. Yasukiro Tashiro, Director, First Division, Import Department
Mr. Hiroshi Nakano, Director, Second Division, Import Department

American Embassy:

Dr. Justin Bloom, Counselor for Scientific Affairs
Mr. Michael Burns, Assistant to Counselor for Scientific Affairs
Mr. Shinsuke Asano, Liaison Officer, Office of Scientific Affairs
Mr. Joseph F. Christiano, Counselor for Commercial Affairs
Mr. Roger N. Benson, Commercial Attache

KOREA

Korea Standards Research Institute (KSRI):

Dr. Zae Quan Kim, President
Dr. Wun Jung, Vice President for Metrology
Dr. Chunghi Rhee, Vice President for Technology
Dr. Yong Suk Hahn, Standing Auditor (Also auditor for Korea Research Institute of Chemical Technology and Korea Institute of Energy Conservation)
Mr. Ki-Sang Choi, Chief, Office of International Cooperation
Dr. Nak Sam Chung, Chief, Electromagnetics Laboratory

Ministry of Construction:

Dr. Jong-Wan Choi, Minister

Korea Science and Engineering Foundation (KOSEF):

Dr. Hyung Sup Choi, Chairman (Also Chairman of KSRI Board of Trustees, Former Minister for Science and Technology)

Korea Advanced Institute of Science (KAIS):

Dr. Soon Tak Cho, President
Dr. Sang Soo Lee, Professor, President Korean Physical Society

Korea Institute of Science and Technology (KIST):

Dr. T. W. Kwon, Vice President for Research
Dr. Yoo Gyeong Yun, Vice President, Management Planning and Control

Korea Research Institute of Chemical Technology (Dae Duk):

Dr. Tae Hyon Lee, President

Hyundai Heavy Industries Co., Ltd. (Ulsan):

Mr. C. S. Han, Executive Managing Director, Nuclear Power Division

Hyundai Motor Co. (Ulsan):

Mr. M. H. Kang, Managing Director of Manufacturing Engineering
Mr. K. H. Jun, Manager, Public Relations

Pohang Iron and Steel Co., Ltd. (Pohang):

Mr. Yong Sun Chough, Deputy General Superintendent
Mr. Sehoon Chang, General Manager, Superintendent, Pohang Works
Dr. Hyun-Soon Park, Superintendent, Technical Research Laboratories

American Embassy:

H. E. William H. Gleysteen, Ambassador
Mr. William E. Paupe, Representative, U.S. AID
Mr. Neboysha R. Brashich, Program Officer, AID
Mr. Leon Wight, Controller, AID
Mr. Robert A. Stella, Science Attache

Members of Board of Trustees, KSRI:

Dr. Hyung Sup Choi, Chairman of the Board
Gen. Chun Hwa Lee, President, Korea Institute of Machinery and Metals
Mr. Eung Sun Lee, Vice Minister, Ministry of Science and Technology
Mr. Young Chul Ahn, Administrator, Industrial Advancement Administration
Dr. Moon Taik Shim, President, Agency for Defense Development
Dr. Chang Nak Choi, Vice Minister, Ministry of Commerce and Industry
Mr. Sun Ki Lee, Vice Minister, Economic Planning Board
Dr. Soon Tak Cho, President, Korea Advanced Institute of Science
Mr. Moon Hwan Cho, Vice Minister, Ministry of National Defense
Mr. S. W. Yu, President, Sun-Kyung Ltd.

Mr. **Brown**. I'd like to have some of the new members of the subcommittee read it also.

Dr. Ambler, I'm sure it's no secret to you that Mr. Reid isn't the only member of the subcommittee concerned about the elimination of the fire research and building technology programs.

Could you describe for us the process by which the decision was made to take this action? By that, I mean: was there any external review of the operation to determine if it was performing satisfactorily—either of these operations?

Was there any consultation with regard to alternative ways of providing this service or was it, in the normal course, merely a part of the OMB's budgetary review situation?

Dr. **Ambler**. It was a part of the budget review process and I'm not sure that I would add merely because the budget review process goes on for quite a long time, sir, and this was debated over a considerable period of time between the Bureau of Standards and the Department and OMB.

Mr. **Brown**. The Bureau, I presume, requested, in their initial request at least, funding for these two programs. Am I correct in this?

Dr. **Ambler**. You mean in the——

Mr. **Brown**. In the budget process.

Dr. **Ambler**. In our initial request to the Department; is that what you mean?

Mr. **Brown**. Yes.

Dr. **Ambler**. Yes, we did request funding for these programs.

Mr. **Brown**. Could you supply the subcommittee with information as to what your original budget request was and—I'm not quite sure I understand your procedures over there but, if you're allowed to provide this subcommittee with the information as to what you originally wanted to have in the budget for that, we'd like to have it.

Can you do that?

Dr. **Ambler**. I think I can, sir, and, if I can, I will.

Mr. **Brown**. All right.

I don't want to get you in trouble with anybody but, to the degree you can, we'd like to have that.

[The information follows:]

In the initial 1984 budget request to the Department of Commerce, NBS requested $4,262,000 for Building Research and $5,036,000 for fire Research.

Now, I would like to focus for a moment——

Mr. **Reid**. If he can't put it there, maybe it could go in the Atlantic Monthly. [Laughter.]

Mr. **Brown**. Possibility.

The Institute for Computer Sciences and Technology—Mr. Burrows, could you elaborate a little bit on what happened there?

Last year, we were faced with an effort to move it over to GSA, as I recall, which apparently didn't go through and there were a lot of objections in the Congress to that.

What happened this year to result in the rather drastic reduction in funding for them—for the Institute?

Mr. **Burrows**. As I understand, sir——

Mr. **Brown**. Just tell us what you understand.

Mr. **Burrows**. In the process of negotiating the Federal budget, various programs were ascertained that they either had low priority or alternate ways to be accomplished.

Mr. **Brown**. Which category did your program fit into?

Mr. **Burrows**. That discussion did not take place in my presence.

Dr. **Ambler**. If I may, I can answer that question, sir.

Mr. **Brown**. Please do, Dr. Ambler—low priority or other ways of providing service?

Dr. **Ambler**. Other ways of providing service.

Mr. **Brown**. And could you elaborate on that a little bit? What the other ways were?

Dr. **Ambler**. Yes, I can, sir.

If I might make just a few general remarks, sir, this budget procedure that I mentioned is one that takes place when the overall policies of the President are made known to the various departments and the President's desire to reduce the Federal deficit was an extremely strong motivation in the whole of the 1984 budget exercise.

I don't think that there was implied at any time critism about the quality of the National Bureau of Standards but it was felt that, in some cases, there might be users who could pay more and there might be other groups in the private sector or, perhaps, in State and local governments who could pick up some of the work.

And the program in the Institute for Computer Sciences and Technology fell into the category where it was our hope and expectation that the private sector might do more and specifically in the area of writing standards.

One of the principal functions of the Institute for Computer Sciences and Technology is carrying out the mandate of the Brooks Act and that calls, among other things, for the writing of Federal information processing standards. It's felt that private sector groups, such as the ANSI committees, could or should do that and that we could adopt those standards for Federal use. And that was the rationale involved, sir.

Mr. **Brown**. Just for my benefit, could either of you describe for me the success that ANSI has had in developing uniform standards over the past 2 years in this field?

Mr. **Burrows**. I would like to take a crack at that.

The essential standards, which I think are critical at this time, are of interest internationally. And both ANSI and any American producer or American user are interested in what's happening in these areas internationally, so ANSI does participate—ANSI committees do participate in the international standards arena to get standards accepted, I think, faster than I've seen in the last 20 years.

In the protocol area, at least since ICST has been heavily committed I think we're accomplishing probably in 3 to 5 years what normally would either have never been done or would have taken 10 or 15 years, so I think things have been sped up.

Mr. **Brown**. You are optimistic that ANSI can take over the role that you've been performing, then? Is that what I infer?

I recognize the difficulty of your responding objectively to that question. I have a vague recollection that you were working on terminal keyboard standards over there. Are you still working on that problem?

Mr. BURROWS. I think we did in the past. They are not a critical part of our activity at the moment.

Mr. BROWN. Did you ever reach agreement with the industry on a standard terminal keyboard?

Mr. BURROWS. There is no standard keyboard.

There is a standard which is not used by a lot of people.

Mr. BROWN. Well, I think the thrust of this line of questioning is to try to ascertain whether or not it is realistic to try to expect a highly competitive industry to reach agreement among themselves on standards which affect their competitive positions in the industry. Could you respond to that general question?

Is that a reasonable thing to expect?

Mr. BURROWS. I think the areas where standards allow the market to grow, the industry will produce standards. In areas where the tendency of the standard is to turn a fixed size market into a commodity-competitive type market, standards will not come from the industry itself.

But users have interest in those standards.

Mr. BROWN. Of course.

How does the Federal Government rate as a user of automatic data processing equipment? What share of the market is represented by the Federal Government?

Mr. BURROWS. That depends upon the area of the market you are looking at. In the overall market, I believe about 5 to 6 percent.

In the super-computer market, we probably fund over half of the super-computers bought either by Government or industry.

In the large computer market, it's more like 6 percent and, in small computers, it's more like 2 percent and, in the microcomputers, nobody has a good "feel" yet.

Mr. BROWN. Let me ask you the same question that I asked with regard to the Fire and Building Technology. Was there any systematic process engaged in in order to determine what mechanism could be established and the possibility that that would reasonably occur for replacing the work that you were doing?

Dr. AMBLER. Should I answer that question?

Mr. BROWN. If you wish.

Dr. AMBLER. The answer to that question is the same as the answer to the question that you asked with regard to Fire and Building Technology.

Mr. BROWN. Mr. Ambler, for some reason or other, you seem to be eliminating, or curtailing, the long-range strategic planning function which you were encouraged to initiate by this subcommittee.

As I understand it, that office is being dismantled and you will try to integrate it with your ordinary budget processes.

Am I correct in this?

Dr. AMBLER. Yes. That function will become part of what we call Programs, Budget and Finance.

Now, I would not want you to think, sir, that that means we are going to stop doing long-range planning. I know you've had a very strong interest in that and have encouraged us to do it.

I think we've learned a great deal and accomplished a great deal since that office has been operating, but I think that the few staff that would remain in the Programs, Budget, and Finance Office, plus the senior management of the Bureau that you see here, and some others are capable of doing enough of that long-range planning to keep the Bureau looking and steering in the right direction.

Mr. BROWN. I wouldn't worry about that too much, Dr. Ambler. If I felt that you had an autonomous operation—which, obviously, no bureau has—but I get the distinct impression that your budgetary decisions and probably most of your planning decisions are being made somewhere else, which does bother me a little bit. I think you can understand that concern, can't you?

Dr. AMBLER. Yes, sir. I suppose that, if you talk to any director of a bureau in the Government, he will be the first to admit that he gets a lot of help in carrying out his responsibilities.

Mr. BROWN. Well, I won't ask you to elaborate on the kind of help you are getting. [Laughter.]

And, believe me, we do understand that it is the prerogative of the President to make budgets. And we just hope that the President understands it is the prerogative of the Congress to make the determination as to the expenditure of funds.

And sometimes I don't think we are quite in balance on that point and our efforts here are to explore how well we are achieving that balance, really.

Thank you, Mr. Chairman.

Mr. REID. Thank you, Mr. Brown.

Mr. Mineta.

Mr. MINETA. Thank you very much, Mr. Chairman.

Dr. Ambler, or maybe Dr. Lyons, I would like to ask about the Center for Fire Research, which has drawn a lot of attention, but I come at this from two different personal perspectives.

One, as having been mayor of a community in which we grew quite rapidly in a relatively short period of time. In about 3½ years, we went from about 400,000 in population to 550,000. The city of San Jose, Calif. The other is my background in the fire and casualty insurance brokerage business.

And the Center for Fire Research is an important asset a national asset. And I am very, very concerned that it is being totally eliminated in the fiscal year 1984 budget. It seems to me that, again, this is a case where the research that is being conducted at the Center has had some high payoff in terms of the results of the Center and yet it's being cut off.

Dr. Lyons, in your own statement, you've got over 2 pages dedicated to the Center itself. I assume that, regardless of the OMB decision here, your personal assessment of the Center is still relatively high. Would that be the case, Dr. Lyons—or Dr. Ambler first and then let me ask Dr. Lyons.

Dr. AMBLER. Well, sir, I think the first thing I would like to say is that we are all here to defend the President's budget.

Mr. MINETA. I understand that.

Dr. AMBLER. By personal assessment, what you are asking is our assessment of the quality of the people and the quality of the work that we've done.

Mr. Mineta. That is correct, aside from the budgetary considerations and your being the spokesperson for the President.

Dr. Ambler. Well, I think that there is no doubt that we are proud of it and perhaps Dr. Lyons, who has had a great deal to do with shaping that program, would want to tell you his sentiment about it.

Dr. Lyons. Well, Congressman Mineta, as Dr. Ambler said earlier, there has never been criticism leveled against the Center as to its work products and their relevance. And I certainly have been, and am, proud not only of the quality of the work but the impact of the work. I would agree completely with what Dr. Ambler just said.

Mr. Mineta. Now, what will happen to the work that is in process at the Center right now? Does that just get cut off or will that be picked up by some group, or does it just get abolished?

Dr. Ambler. The justification for the zeroing of the direct appropriation for the Center for Fire Research in this budget is that work should be more appropriately funded and carried out in the private sector or through support of State and local governments and, to the extent that that materializes, the work will get done.

There will be no funding in fiscal 1984 for the fire program, so obviously we wouldn't carry out that work. There is still the question of the work that we do for other agencies that I mentioned in my testimony and there I would be reluctant to carry that on for any long period of time. It seems to me that it's never very successful for us to run a program without direct appropriation. You end up by being a job shop and losing your long-range capabilities, so, while that might continue for a time, we would not expect to continue it indefinitely and would hope that somebody else could pick it up.

Mr. Mineta. And have you been approached by any private sector organization or anybody to pick up on some of the work that is in process but now is going to have to be abolished at the Center for Fire Research?

Dr. Ambler. No, sir.

Mr. Mineta. Well, then, let me ask: before saying that this is rightfully more in the private sector and there may be some validity to that, was a study or some kind of assessment done to see whether or not there would be anybody—universities, Underwriters Lab, National Fire Protection Association—anybody picking up any of this research that was being undertaken by the Center?

Dr. Ambler. No, sir. A study of that sort was not made. I hope you understand that it would be very difficult for me to do anything along those lines until the President's budget had been submitted to Congress.

Since then, there hasn't been enough time to do that, so, no. There has been no study made.

Mr. Mineta. I also chair the aviation subcommittee for the House Public Works and Transportation Committee.

And, of course, fire in aviation is a very important aspect of our work—fire, toxicity, smoke—in terms of airplane crashes.

Part of the work that you are doing down there in the Center for Fire Research is that involving toxicity arising from fires and I'm very concerned about that toxicity research that's being done, and the technology transfer, so to speak, or the research transfer that is available for what is available through the Center for Fire Research, and so I have a specific interest because we've had a very large fatal fire in San Jose in which the firefighters pulled a victim from an apartment house and found that hydrochloric acid was dripping from heated insulation coming from the wiring between the first and second floors of the building that really worked as a heating element and melted the insulation and that turned into hydrochloric acid.

And this kind of toxicity research is being conducted by the Center now and now all of a sudden, fiscal year 1984—at least at the beginning of it, as of the 30th of September of this year, gets cut off.

I think there is just a lot of work being done in the Center right now that is going to be lost to all of us.

Let me turn to just another sector of this Center work. And that is as it relates to university research. What happens to those university research programs that are now being funded by the Center?

Dr. AMBLER. Those are included in the budget and they would stop.

Mr. MINETA. And you are expecting the universities to pick up on these costs?

Dr. AMBLER. Well, not the universities themselves, but they could turn elsewhere to get support.

Mr. MINETA. Dr. Lyons, has there been any discussion with the university community since the President's budget has come out, with maybe some of the concerns that Harvard, Cal Tech, Berkeley, Princeton, Notre Dame, Brown, Northwestern, Maryland, Clemson, Florida, Massachusetts, Michigan, Pittsburgh, Montana, Penn State, Case Western, or Washington might have expressed to you about the President's budget and the cutoff of these funds for university research?

Dr. LYONS. Well, they are obviously not pleased. I might point out that many of those investigators were funded by the National Science Foundation before the Center was created in 1974, under the old RANN program, and it is our presumption that those university people who wish to remain in this field would have to apply for funding back to NSF or to the various mission agencies that have these problems.

Mr. MINETA. That's not a recent phenomenon. The Center has been funding these since 1976.

Dr. LYONS. That's true.

Mr. MINETA. I mean that's not something that just happened recently.

Dr. LYONS. No, no.

Mr. MINETA. 1976. I mean there's been a lot of——

Dr. LYONS. That's correct.

Mr. MINETA [continuing]. Water that's gone under the bridge.

Dr. LYONS. They would have to seek alternate sources or leave the field.

Mr. MINETA. Again, it seems to me that we are making some short-term cost savings that will, in the long run, be very costly to industry, to the taxpayers, to—just in my own area, I suppose insurance rates are determined by class of protection being provided by the kinds of safe building materials—even safety to fires.

We are getting to learn more about the flame and how it acts in a building and, through the laser research that's being done there in the Center, we are getting to know more about the behavioral nature of fire and flame for the protection of firefighters.

It seems to me that that, again, is a very important program as it relates to life and limb as well as to the physical buildings that the Fire Research Center has been able to get more information for us.

Now, given the fact that the RANN program was transferred from National Science Foundation to NBS, is there a natural home, Dr. Lyons, that you might suggest? I mean you said it came to us from NSF in the first place and it can go back there, but is there a natural home left at NSF for the kinds of proposals that NBS grants in the fire area?

Dr. LYONS. Well, there is no home labeled fire engineering or fire research. I suppose that the program would have to be fragmented so that the flame research which you describe would probably go under the chemistry section—the laser chemistry section.

The flame spread and development would probably go into the fluid mechanics part of the mechanical engineering in the engineering directorate and so on.

Mr. MINETA. Well, again, Dr. Ambler and Dr. Lyons and the panel, thank you very much for your presentation here today.

Thank you, Mr. Chairman.

Mr. REID. Mr. Sensenbrenner, do you have a question?

Mr. SENSENBRENNER. No questions, Mr. Chairman.

Mr. REID. I would just ask one question.

I have been informed by the staff—and, in my reading, I recall something to this effect: that the Congress has appropriated moneys for a computer for the Bureau of Standards previously, and that's been ongoing for some time and it's one of those things that's been studied to death.

It's my understanding there's still no computer. Is that right?

Dr. AMBLER. Excuse me, sir?

Mr. REID. Still no new computer?

Dr. AMBLER. No, sir. Not yet. The Department has made a decision to place a computer at NBS Gaithersburg that will serve both the National Bureau of Standards and parts of NOAA.

Mr. REID. You are satisfied with that?

Dr. AMBLER. I think the solution is a good one in that it would, as presented, certainly take care of our computer requirements.

Mr. REID. How much money do you have available now for purchasing this computer?

Dr. AMBLER. In the Bureau of Standards budget?

Mr. REID. Yes.

Dr. AMBLER. It's $6.7 million.

Mr. REID. So the money is there?

Dr. AMBLER. Well, that's—some of the money; this is a joint effort.

Mr. REID. Is this adequate to cover the proposed sharing, so to speak?

Dr. AMBLER. I think it covers our share. I don't think it covers the whole thing, no, sir.

Mr. REID. It covers the whole thing or just your share?

Dr. AMBLER. Well, the $6.7 million that I mentioned will be used toward the purchase of the computer.

Mr. REID. I know, but is——

Dr. AMBLER. That is not enough in itself.

Mr. REID. But is that your share, so to speak? Is that all you would be asking for?

You don't need more money?

Dr. AMBLER. That's what we have in the budget.

Mr. REID. I understand that. But is that enough in conjunction with what the other agency is going to come up with to buy the computer?

[No response.]

Mr. REID. I can see that no one knows for sure. Would you supply that information for us, please?

Dr. AMBLER. I don't have that information but, if I may, I will ask the Department to supply it to you.

[The information follows:]

The Department of Commerce is preparing to purchase a scientific computer to be shared by NBS and NOAA. As part of the planning phase we are assessing resource availability from both organizations. Further details on funding implications will be available once this assessment has been completed.

Mr. REID. That will be fine. I will appreciate it.

If there are no more questions from any of the committee members, this subcommittee will adjourn until 9:30 tomorrow morning.

Thank you.

[Whereupon, at 3:45 p.m., the subcommittee recessed, to reconvene at 9:30 a.m., March 23, 1983.]

1984 NATIONAL BUREAU OF STANDARDS AUTHORIZATION

WEDNESDAY, MARCH 23, 1983

House of Representatives,
Committee on Science and Technology,
Subcommittee on Science, Research and Technology,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:30 a.m., in room 2325, Rayburn House Office Building, Hon. Doug Walgren (chairman) presiding.

Present: Representatives Walgren, Brown, Valentine, MacKay, Reid, Bateman, Gregg, Boelhert, Sensenbrenner, Skeen, and McGrath.

Mr. Walgren. Welcome to our second day of hearings on the National Bureau of Standards and related programs.

Yesterday we heard from the Government witnesses on the programs which they are recommending and the changes that they recommend.

Today we have a number of people who have very direct involvement and alternative perspectives on those proposals, and we want to start with the Honorable Michael Barnes. He is the only Congressman we have in this area, if you read the Washington Post, and he has tremendous presence in the press.

The rest of us envy that very much. We are glad you came to the committee and we wish to welcome you. Written statements will be made a part of the record automatically, and please proceed as you desire.

STATEMENT OF MICHAEL D. BARNES, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MARYLAND

Mr. Barnes. Thank you very much, Mr. Chairman. I very much appreciate the opportunity to appear before your subcommittee this morning.

I am going to focus my comments just on the issue of the administration's proposal to eliminate the Center for Building Technology, and the Center for Fire Research.

I recognize that your responsibilities go well beyond that in terms of what you are considering in these hearings, but I am particularly concerned about these proposals of the administration, and I want to address that briefly.

I realize you have a lot of witnesses, but this is a very important issue not only to me and my district, but really to the country, as I think is demonstrable.

I regret that the administration in what I regard as shortsightedness has made it necessary to rally to the defense of two of the Nation's really most distinguished public research organizations, the Center for Building Technology and the Center for Fire Research.

The administration proposes to eliminate funding for both of these organizations.

They want to knock out $3.17 million in building research and $5.89 million in fire research, essentially eliminating these programs totally.

The proposed reduction in one of the core efforts of the National Bureau of Standards reflects the administration's ongoing drive to privatize Federal efforts, particularly in the research field.

Ironically, my testimony today really in large part summarizes the private sector's overwhelming rejection of this particular form of privatization.

In hearings before this and other committees of Congress and in countless letters from private industry leaders, we are being told in no uncertain terms that the work that is being done by these two organizations typifies what is best in Government.

The private construction firms in fact regard the research that advances fire prevention and building construction standards as the result of private/public partnership. My brief testimony this morning focuses on three considerations.

First of all, that the proposed budget savings are offset many times as a result of discontinuing the work of the Center for Building Technology and the Center for Fire Research.

Second, that eliminating these centers cripples our Nation's building code and fire research programs, and finally, that private firms rely heavily on the output of these centers, and have expressed really just outrage at the proposed elimination of them.

I should not in other circumstances in addressing actions that affect jobs of hundreds of employees, Federal, I have a good deal to say about the efforts to deprive Government of its best talent.

Last year I introduced a bill which we are reintroducing this year, a bill to enable labor and management and the Federal sector to seek alternatives to wasteful reductions in force. In the present case at these two centers, 400 full-time permanent and another 200 part-time positions are at stake, but in my view, this is a case in which the alternative to a RIF is a simple one.

These programs deserve full funding and full support of the Federal Government. Given the increasing complexity of modern building practices and our Nation's dismal record in the area of loss of life related to fires, anything less than such a commitment, I think, would be really irresponsible for us to undertake. With respect to the layoffs, I think we can say that the individuals, most of them, involved in these jobs are not people who will have that difficult a time getting a job somewhere else.

I don't know if you saw the news report last night where they interviewed some of the workers. They said, "That is not our concern; we are in demand."

These are technical people with tremendous expertise and talent. As they said in response to questions on the news, we think we are performing an important service here and we would like to remain in public service and continue these jobs, even though obviously many of those folks could make a lot more money if they left public service and if these programs were in fact eliminated.

The Center's work provides major savings to both private firms and the Federal budget. Building costs to the Federal Government can be reduced in a number of ways, advances in productivity, for example, and how we utilize cement that can add years of life to Federal buildings and reduce our annual maintenance costs, together with the National Conference of States on Building Codes and Standards, they produced an energy conservation code for new building construction that directly affects energy use of new Federal facilities.

Other ways in which building and fire research saves precious Federal and non-Federal resources include, one, elimination of wasteful and inefficient regulations; two, advancing fire and safety techniques that can minimize and in some instances control fire damage—through the development of fire and building codes; three, minimize losses associated with natural disasters, including earthquake hazards; four, saving lives that would otherwise be lost in fire-related incidents; five, reducing casualty losses associated with natural or manmade disasters; and six, enhancing the Nation's international competitive position in the construction and building industries.

This list could go on and on, and those of you who are familiar with the work in these two centers are aware of that. Evidence of budget savings to the Federal Government alone would far outweight the savings proposed to the elimination of these two centers.

The savings are minimal and I would also recommend that the subcommittee, if it has any doubts on this subject, instruct GAO to undertake such an analysis prior to determining the fate of these programs.

I am confident that any objective, independent analysis would bear out the statement that I have made with respect to the offset of the savings.

A critical feature of Federal building and fire research is that it really can't be replaced. I have been alerted that the elimination of these programs would leave the United States apparently the only nation in the world without a national fire and building research program of some kind.

The National Institute of Building Sciences put the matter into perspective:

> The system for developing building standards in the United States is characterized by two important features; it is largely voluntary and it is highly fragmented and decentralized.
>
> These facts reflect the composition of the building community in this country which is comprised of thousands of small business and special interest groups. Architects, engineers, builders, product managers and equipment suppliers—a great many of whom are small and marginally financed—are highly competitive and have limited ability to invest in basic research and development activities.
>
> As a result, the development of new technology for the process is slow and what R&D is conducted by the private sector is largely proprietary, somewhat disorganized and frequently geared to short or mid-term objectives.

The Institute also notes that "The United States already spends less per capita on building research than the government of any other developed nation.

I might add that the Federal Government spends less on research applicable to the building industries than it does for most other industrially related research—despite the fact that construction represents a significant portion of the GNP and that 70 percent of the Nation's wealth is represented by the value of constructed facilities.

In 1981 our Nation spent $278 billion on health services and the Federal Government spent $4 billion on health research at NIH. We spent $276 billion for food products and nearly a billion dollars for food research at the Department of Agriculture, but although we spent $227 billion for construction as a Nation, in 1981 we spent only $22 million on related research at the Bureau of Standards.

Now, the administration wants all of that research to be eliminated, to disappear. Well, it simply makes no sense. In short, Mr. Chairman, no one else is going to do this work and it is vitally important work for a country.

The consequences of eliminating fire research would be absolutely grim. There were two fire deaths here in the Washington area last night in separate fires just here in Washington, in the last 15 hours or so.

Two million dollars in research grants to leading universities and laboratories to do this kind of research, to eliminate those losses of life in this country would be eliminated, if the administration's proposal is accepted.

Basic knowledge of how flames spread, the role of soot formation in fire damage and how to design safer materials would cease to grow. This cessation would come at a time when fire research is—I think and the experts tell me—poised on the brink of a new era.

Computer-based fire simulators that could be used by building designers, by code officials, fire service officers and firefighters could bring with them a quantum leap in our ability to save lives and property. Halting the Center's work at this time threatens that progress which they are making in this vitally important research.

We can't turn our back on this work or on the fact that it can turn around our situation, as the single Nation with the worst fire loss record of any nation in the world.

I want to just, as I mentioned at the outset, turn to the reaction of the private sector, the business community, to what the administration has proposed in terms of eliminating these two agencies.

The American Society of Civil Engineers says,

> The private sector neither can nor would be inclined to fill the major void created by eliminating the Center for Building Technology.

The U.S. Chamber of Commerce says:

> The Center has undertaken a wide range of activities that have resulted in improvements in construction technology and enhanced the operation of the market place to the advantage of both industry and the consumer.

The chamber also noted that working with the Center for Building Technology on commercial construction productivity was "one of the most successful efforts in public/private partnership."

The Atlantic Cement Co. says:

> We believe strongly in private R&D, but the Center for Building Technology is the only integrated program able to deal with complex technical issues affecting the entire building industry.

Martin Marietta, one of my constituent companies, says:

> The impact on the progress in the cement chemistry research will place progress on a virtual hold in the United States.

I can go on and on quoting. We received a letter from a firm of architects and engineers in Salt Lake City that said:

> I hope you will thoroughly study the activities and research programs at the Center for Building Technology. If you do, I think you will agree that they are necessary if the United States is to remain in the forefront of technological development.

I just received a letter from a consulting engineering firm in my district that I would like to have placed in the record, if I may, Mr. Chairman, of your hearing in which they just make a very strong case.

Let me read a couple of paragraphs. In this letter they say:

> We think back on all the research and reports in building areas such as steel corrosion protection, insulation performance, security barriers, solar energy, earthquake resistant design, building acoustics, roof membranes, safe egress and stairwell design.
>
> We think back on all the research and reports in fire-related areas such as flame spread, flashover, carpet flammability, firemen's turnout coats, smoke and gases produced by burning materials, fabric flammability and upholstered furniture ignition.

These agencies do terribly important work. They say:

> The Bureau's outstanding centers are known across the country and indeed around the world. Their careful research and detailed, clear reports serve as examples for the engineering and scientific communities of our country.

Now, that is not some liberal fighting for jobs for Federal employees arguing this. This is a business community saying that we need these agencies to continue their important work.

Mr. Chairman, I could go on and on all day citing these kinds of testaments to the important work of these agencies, but your committee has a lot of other witness to hear from.

Those who would benefit most from the administration's privatization effort clearly don't want us to save them. They are telling us, we don't want this to be privatized.

They would rather be partners with what they found to be a good friend, perhaps a golden friend from the standpoint of their businesses, because the research that has been carried out has improved construction technology and fire resistance in this country.

I would urge your subcommittee to thoroughly reject the administration's proposal out right. If there is any way in which I can be of assistance to you, Mr. Chairman, or any of the members of the subcommittee on this, I would be delighted to do so.

I have had the chance to go out to the Bureau of Standards and visit and see the kind of expertise that is serving our country in these areas, and I think if you have not had that chance and if you are really seriously thinking about voting to eliminate these programs, take a couple hours and run out to Gaithersburg and meet with the people who are engaged in these activities and I am absolutely convinced that you will feel as I do, that we would be crazy to do away with these programs.

[The prepared statement of Mr. Barnes follows:]

STATEMENT BY REPRESENTATIVE MICHAEL D. BARNES ON THE PROPOSED ELIMINATION OF THE CENTER FOR BUILDING TECHNOLOGY (CBT) AND THE CENTER FOR FIRE RESEARCH (CFR)

Mr. Chairman, I appreciate the opportunity to appear before your subcommittee today on a subject that is, in my view, of the greatest importance to the quality of life in our Nation. I would add, Mr. Chairman, that I regret that the Administration, in its short-sightedness, made it necessary to rally to the defense of two of the Nation's most distinguished public research organizations; the Center for Building Technology and the Center for Fire Research. The Administration proposes to eliminate funding for both of these organizations on two premises. First, that $3.17 million in building research would be saved in fiscal year 1984 and second, that $5.89 million in fire research would also be saved.

This proposed reduction in one of the core efforts of the National Bureau of Standards reflects the Administration's on-going drive to privatize Federal efforts, particularly in the research field. Ironically, Mr. Chairman, my testimony today in large part summarizes the private sector's overwhelming rejection of this particular form of privatization. In hearings before this and other committees of Congress, and in countless letters from private industry leaders, we are being told in no uncertain terms that the work being done by these two organizations typifies what is best in government. The private construction firms, in fact, regard the research that advances fire prevention and building construction standards as the result of private-public partnership.

My brief testimony this morning focuses on three considerations:

(a) that proposed budget savings are offset many times as a result of discontinuing the work of the Center for Building Technology and the Center for Fire Research;

(b) that eliminating these centers cripples the Nation's building code and fire research programs; and;

(c) that private firms rely on the output of the centers and have expressed outrage at their proposed elimination.

I should note, Mr. Chairman, that in other circumstances, in addressing actions that threaten the jobs of hundreds of Federal employees, I have a good deal to say about the short-comings of policies that deprive government of its finest talent. As you may know, last year, I introduced legislation—the Fair Reduction in Force Practices Act of 1982—to enable labor and management in the Federal sector to seek alternatives to wasteful reductions in force. In the present case at the CBT and CFR, 400 full time permanent and another 200 part time positions are at stake. But in my view, this is a case in which the alternative to RIF is a simple one; these programs deserve full funding and full support of the Federal government. Given the increasing complexity of modern building practices, and this Nation's dismal record in the area of loss of life related to fires, anything less than such a commitment, Mr. Chairman, would be irresponsible.

I. Offsets Outweigh Savings

The centers' work provides major savings to both private firms and the Federal budget. Building costs to the Federal government can be reduced in a number of ways. Advances in productivity, for example, in how we utilize cement can add years of life to Federal buildings and reduce annual maintenance costs dramatically. Together with the National Conference of States on Building Codes and Standards, Inc., the Center for Building Technology produced an Energy Conservation Code for New Building Construction that directly affects the energy use of new Federal facilities.

Other ways in which building and fire research saves precious Federal and non-Federal resources include:

(1) elimination of wasteful and inefficient regulations;

(2) advancing fire and safety techniques that can minimize and in some instances control fire damage (through the development of fire and building codes);

(3) minimizes losses associated with natural disaster, including earthquake hazards;

(4) saving lives that would otherwise be lost in fire-related incidents;

(5) reducing casualty losses associated with natural or man-made disasters;

(6) enhances the Nation's international competitive position in the construction and building industries, and the list could go on and on.

In each of these areas, I am convinced that evidence of budget savings to the Federal government alone would far outweigh the savings proposed through the elimination of the CBT and CFR. I would also recommend that the Subcommittee, if it has any doubts on this subject, instruct the General Accounting Office to undertake such an analysis prior to determining the fate of these programs.

II. Crippling National Programs

A critical feature of Federal building and fire research is that it cannot be replaced. I have been alerted that the elimination of these programs would leave the U.S. the only nation in the world without a national fire and building research program. The National Institute of Building Sciences put the matter into perspective:

"The system for developing building standards in the United States is characterized by two important features; it is largely voluntary and it is highly fragmented and decentralized. These facts reflect the composition of the building community in this country which is comprised of thousands of small business and special interest groups. Architects, engineers, builders, product managers and equipment suppliers—a great many of whom are small and marginally financed—are highly competitive and have limited ability to invest in basic research and development activities. As a result, the development of new technology for the process is slow and what R & D is conducted by the private sector is largely proprietary, somewhat disorganized and frequently geared to short or mid term objectives."

The Institute also notes that "the U.S. already spends less per capita on building research than the government of any other developed nation." I might add that the Federal government spends less on research applicable to the building industries than it does for most other industrially related research—despite the fact that construction represents a significant portion of the GNP and that 70 percent of the Nation's wealth is represented by the value of constructed facilities.

For example, in 1981 the Nation spent $278 billion on health services and the Federal government spent $4 billion on health research at the National Institutes of Health. We spent $276 billion for food products and nearly $1 billion for food research at the Department of Agriculture. But although we spent $237 billion for construction in 1981, we spent only $22 million on related research at the National Bureau of Standards. Now the Administration wants all of this research to disappear. This simply makes no sense.

In short, Mr. Chairman, no one else can do this work and it is vitally important that the work continue.

The consequences of eliminating fire research in the U.S. would be equally grim. $2 million in research grants to leading universities and laboratories would be lost. Basic knowledge of how flames spread, the role of soot formation in fire damage, and how to design safer materials would cease to grow. This cessation would come at a time when fire research is poised on the brink of a new era. Computer based fire simulators that would be used by building designers, code officials, fire service officers and fire fighters could bring with them a quantum leap in our ability to save lives and property. Halting CFR's work at this time threatens that progress.

We can not turn our back on this work or the fact that it can turn around our current situation—as the single nation with the worst fire loss record of any nation in the world.

III. Reaction From the Private Sector

The following private organizations have expressed their view that the research of the CBT and the CFR is irreplaceable:

The American Society of Civil Engineers—"the private sector neither can nor would be inclined to fill the major void created by eliminating the Center for Building Technology."

The U.S. Chamber of Commerce—"CBT has undertaken a wide range of activities that have resulted in improvements in construction technology and enhanced the operation of the market place to the advantage of both industry and the consumer." The Chamber also noted that working with CBT on commercial construction productivity was "one of the most successful efforts in public/private partnership."

Atlantic Cement, Stanford Connecticut—"we believe strongly in private R & D, but CBT is the only integrated program able to deal with complex technical issues affecting the entire building industry."

Martin Marietta, Master Builders—"The impact on the progress in the cement chemistry research will place progress on a virtual hold in the United States."

Swenson, Smith, Crane, Architechts/Engineers (Salt Lake City)—"I hope you will thoroughly study the activities and research programs at CBT. If you do, I think you will agree that they are necessary if the United States is to remain in the forefront of technological development."

Mr. Chairman, I could, of course, go on, and on. Those who would most benefit from the administration's privatization effort clearly do not want us to save them.

They would rather be partners with a good friend—perhaps a rather golden friend from the standpoint of their businesses. I would therefore urge this Subcommittee to thoroughly reject the Administration's proposal. If there is any way in which I or the Federal Government Service Task Force, which I chair, can assist this Subcommittee in this effort, please do not hesitate to let me know.

Mr. **Walgren**. Thank you very much.

In my own personal view, the reaction of the private sector is right on target. They have expressed themselves to this committee along exactly the same lines that they have expressed themselves to you.

Somehow or other, I just keep thinking back on dormitory arguments in colleges in which it became painfully clear that any philosophical approach taken to its limits was absurd, and this seems to me to be exactly what is happening in this administration, when you find them recommending not just reductions or budgetary restraint, but wholesale, complete elimination of programs that clearly have great value.

Are there other members of the committee who would like to raise a subject.

Mr. **Gregg**. Mr. Chairman, I would like to congratulate the Congressman for an eloquent, well-thought-out, well-researched statement, and I appreciate his being here.

Mr. **Barnes**. Thank you very much.

Mr. **Walgren**. Thank you very much.

Next, the Honorable Berkley Bedell from Iowa. Welcome to the committee. We really appreciate your coming and giving us your thoughts on the administration's recommendations in this area.

I know the recycled oil program is one that has been of interest to you in this cluster that we are reviewing today, and we would appreciate your perspectives in any way you want to give them to the committee.

STATEMENT OF BERKLEY BEDELL, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF IOWA

Mr. **Bedell**. Thank you, Mr. Chairman.

My statement is fairly short. I should tell you I was Chairman of the Energy Subcommittee of the Small Business Committee in the last session, and that is how I became involved in this particular issue.

Many of us have been anxiously awaiting the test standards for re-refined waste oil from the National Bureau of Standards. This hearing provides an excellent opportunity to stress the value of those standards.

They are particularly relevant in light of recent events regarding dioxin contamination, which unfortunately may continue to happen if waste oil remains unregulated.

In the last Congress, I chaired the Small Business Committee's Subcommittee on Energy and the Environment. We held hearings on waste oil re-refining and were concerned about the fact that no one in the Government seemed to care about this issue.

There is no doubt, waste oil re-refiners can play a vital role in reducing the potential environmental contamination from careless waste oil disposal. Strong standards can control the disposal of contaminated waste oil.

Strong standards would also play an important part in helping to conserve petroleum. In the hearing held by the Energy subcommittee last year, we sought to learn why more used oil is not being recovered and re-used in this country.

A great amount of used oil is being burned indiscriminately, emitting harmful pollutants into the atmosphere. This is particularly distressing considering the incredible potential for conservation by recycling this waste oil, and the barriers the Government has enacted that will in effect prevent greater re-refining of used oil.

Waste oil research by the National Bureau of Standards is proceeding very slowly. In addition, NBS is proposing to discontinue its standard-setting research even though it is in the final, and in fact, most crucial phase.

Completion of this research, which includes base stock consistency, equivalency and verification studies, is of vital importance to the oil recovery industry and to the oil-consuming public.

Since 1978 the NBS has been working on the second and final phase of its recycling program. Unless verification of crucial engine sequence tests is accomplished, past research and development tests will not be proven and past funding will have been wasted.

The administration suggests that industry should pick up the pieces of the almost-completed testing program. This is simply untenable.

In letters sent to my subcommittee by representatives of the waste oil refining industry, I was told that any research done in the field would not have any credibility without the NBS reputation behind them. This point is particularly important, because the public must have confidence in the re-refined product in order for the industry to be successful in the marketplace.

I would like to point out here that our country lags far behind European nations, particularly West Germany and Italy, in its recycled oil industry's percentage of the total lubricant market.

The West German effort has been particularly successful with recycled oil making up 19.7 percent of its total lubricant market. Italy follows close behind with 13 percent, while in the United States, recycled oil makes up only 3.4 to 5.1 percent of our lubricant market.

As I was saying before, waste oil refiners are small, privately held businesses that have neither the capital nor the technical sophistication to complete the NBS work. Besides, the Government has an obligation to complete the work it has begun at NBS.

This obligation is recognized by Congress. Section 383[c] of the Energy Policy and Conservation Act mandates NBS to develop these test procedures.

The NBS recycled oil program was funded at $1 million for fiscal year 1983. I understand that the waste oil refining industry expects the NBS work to be completed by the end of fiscal year 1984, and has requested only $800,000 for fiscal year 1984 in order to complete the research.

I urge you to continue the efforts to make sure this program is carried out at the National Bureau of Standards.

In closing, I want to commend again the gentleman from Pennsylvania, Mr. Walgren, for holding these hearings today, and thank him for the opportunity to speak before you all today.

It would be inexcusable not to finish up the work that we have spent 3 years on which would enable us to help us with our energy problem and our pollution problem and to help provide an industry that can make use of something that is otherwise going to cause you problems.

[The prepared statement of Mr. Bedell follows:]

STATEMENT OF HON. BERKLEY BEDELL

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In the last Congress, I chaired the Small Business Committee's Subcommittee on Energy and the Environment. We held hearings on waste oil re-refining and were concerned about the fact that no one in the government seemed to care about this issue. There is no doubt, waste oil re-refiners can play a vital role in reducing the potential environmental contamination from careless waste oil disposal. Strong standards can control the disposal of contaminated waste oil. Strong standards would also play an important part in helping to conserve petroleum.

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Waste oil research by the National Bureau of Standards (NBS) is proceeding very slowly. In addition, NBS is proposing to discontinue its standard-setting research even though it is in the final, and in fact, most crucial phase. Completion of this research, which includes base stock consistency, equivalency and verification studies, is of vital importance to the oil recovery industry and to the oil consuming public.

Since 1978, the NBS has been working on the second and final phase of its recycling program. Unless verification of crucial engine sequence tests is accomplished, past research and development tests will not be proven and past funding will have been wasted.

The Administration suggests that industry should pick up the pieces of the almost-completed testing program. This is simply untenable. In letters sent to my Subcommittee by representatives of the waste oil refining industry, I was told that any research done in the field would not have any credibility without the NBS reputation behind them. This point is particularly important, because the public must have confidence in the re-refined product in order for the industry to be successful in the marketplace.

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The NBS recycled oil program was funded at $1 million for fiscal year 1983. I understand that the waste oil refining industry expects the NBS work to be completed by the end of fiscal year 1984, and has requested only $800,000 for fiscal year 1984 in order to complete the research.

I urge you to continue the efforts to make sure this program is carried out at the National Bureau of Standards.

In closing, I want to commend again the gentleman from Pennsylvania, Mr. Walgren, for holding these hearings today, and thank him for the opportunity to speak before you all today.

Mr. **Walgren**. Well, we certainly appreciate your calling our attention so directly to that particular program.

Oftentimes in Government we sort of walk up to the ledge and then just don't complete the project, and there is a loss in that and I know we will focus very directly on it.

Are there members of the committee who would like to pursue this subject with Mr. Bedell?

Mr. **Skeen**. Mr. Chairman, I want to commend him on a fine piece of work. This has been a concern of a lot of us.

In this great United States we waste an awful lot of products, natural resources. We do the same thing not only with used oil, but with used tires which should be probably part of this kind of a study, and I am glad that your program was refunded.

You have done a real good job in stating your statement and if we Americans would have to do something like the Europeans have been doing for years and have to learn how to recycle and live with these things, we would be far more interested in them.

The bottom line is that we need to make them economically feasible. So I appreciate your efforts.

Mr. **Bedell**. I want to be sure the committee understands. The effort here is to get the National Bureau of Standards to complete their testing so that they can come out with regulations that say if re-refined oil meets these specifications, it will then be equivalent to new oil and most of the customers are industrial customers, and if they can get those regulations out of NBS, then they will be able, indeed, to sell their re-refined oil in the marketplace, whereas without those, they simply cannot do it because the users do not have the confidence in the product without such a regulation.

Mr. **Walgren**. That is the critical place for the National Bureau of Standards' stamp of approval, because otherwise, the consumer might assume that somebody was trying to sell something that might do damage to his equipment, and the savings would hardly be worth the expense.

Mr. **Bedell**. That is right. That is why it has to be done by Government in order to give it that credibility, and it is only 1 year left in the whole program.

Mr. **Walgren**. The work that remains to be done is essentially this engine certification?

Mr. **Bedell**. Correct.

Mr. **Skeen**. Mr. Chairman, I would like to add something. I was speaking to the essential part of what your program is, that being to keep the NBS involved in this thing, because the American public does not realize or has not been told of late. It used to be common knowledge back in maybe the fifties and forties that used motor oil is a better product when it is re-worked. You are too young to remember that time,

You never wear out motor oil. Most folks don't understand that. However, it is a better product because you burn up a lot of impurities in the oil and there used to be a company that sold used motor oil throughout the United States, and it was highly recommended by those consumer testers at that time as a superior product. But, I guess the feasibility didn't work out or something of that kind. Nevertheless it is a very interesting study and I still commend you for the work that you are doing.

Mr. BEDELL. If we could get some Government agency to figure out a way so you and I would not wear out.

Mr. SKEEN. They are working on it. They are called wives.

Mr. WALGREN. Thank you very much, Berkley.

Focusing on the recycled program, we would like to call forward James McBain, Executive Director of the Association of Petroleum Re-refiners for testimony on exactly this point.

Welcome to the committee. We appreciate your being here. Your written statement or any submission that you would like to make along that line will be made a part of the record in full and please proceed as you feel you would like to.

STATEMENT OF JAMES B. McBAIN, EXECUTIVE DIRECTOR, ASSOCIATION OF PETROLEUM RE-REFINERS, WASHINGTON, D.C.

Mr. McBAIN. I have a written statement which I hope you will put in the record. I had an oral statement, but Mr. Bedell has said it much better than I could.

I would like to answer some of the questions that you mentioned. For example, the NBS has already contracted for what they call engine sequence testing which is very important because it validates all the work they have done in the past 4 or 5 years.

What they are doing is they have set a—developed a series of bench tests that industry, the Government and the public, can use to determine when one particular oil is equal to another.

In order to prove that that is right, they now have to test oils in the engines. Those tests are scheduled to begin in June of this year and finish in December of this year which is well into the fiscal year 1984.

For that reason, we feel, as Mr. Bedell does, that it is very important for $800,000, the amount that is necessary, that this program can be finished, completed and all the value relate to the industry.

There is no intermediate benefits from this program. If they quit now, we couldn't apply those tests because they wouldn't have any proven value.

I would like to leave one other thought for the committee with regard to recycled oil. At the completion of the NBS program on recycled oil, the people will be disbanded and all the expertise dissipated.

Road oil was used for dust suppressant laced with dioxin. Without the expertise, without any Federal center for expertise in refining oil, people like at Times Beach could not go anywhere and get help.

For example, if they knew that there was some Federal expertise in the area of recycled oil, they could have asked the NBS for help in determining what sort of contaminants were in the oil.

I know that small town, even a road oiler can't afford to do those tests. It is $5,000 per test to test for one chemical and we hope the committee will consider maintaing some expertise in the NBS on a permanent basis and this can be done for about $200,000 per year.

[The prepared statement of Mr. McBain follows:]

STATEMENT
OF THE
ASSOCIATION OF PETROLEUM RE-REFINERS
BEFORE THE
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
ON THE
1984 BUDGET FOR THE NATIONAL BUREAU OF STANDARDS

WEDNESDAY, MARCH 23, 1983

Mr. Chairman:

I am James A. McBain, Executive Director of the Association of Petroleum Re-refiners whose membership consists of small businesses engaged in the re-refining and reclamation of used oil to automotive and industrial lubricants and other industrial uses.

We are present today to ask that the committee include funding in the National Bureau of Standards 1984 budget for the completion of the current NBS research on recycled oil. The proposed budget contains no funds for this research although the program could be completed in Fiscal Year 1984. Earlier funding for this program was about 1.25 million per year. This was reduced to one million for 1983. We understand that $800,000 in FY 1984 would be sufficient to complete the research.

The recovery of used oil is beneficial to the environment and the conservation of our own natural resources and it is a small but important step in the goal of energy independence. With this in mind, Congress passed Public Law 96-463, the Used Oil Recycling Act, in 1980. This legislation aided the growth of the re-refining industry in the United States and is helping in the increased recovery of the 1.2 to 1.5 billion gallons of used oil that this country generates annually.

One of the most important and necessary factors to the complete recovery and re-use of used oil is the availability of simple and inexpensive test procedures to determine the quality and substantial equivalence of recycled oils to their virgin counterparts. The National Bureau of Standards has been conducting valuable research in this area since 1976. The first phase of this research, which related to used oil utilized as a fuel, is completed, and the report was published in 1978.

Since that time, the Bureau has been working on Phase II of the program which relates to lubricating oils. This is the most important aspect of the entire program. Completion of this research, including base stock consistency, equivalence and verification studies is of vital importance to the oil recovery industry and the lubricating oil consuming public as well.

The NBS has completed almost all of its research to develop test procedures for determining consistency and equivalency. They are now in the final phase of arranging for engine sequence testing to determine if the procedures developed in the earlier phases of the research are valid. Without the verification provided by the engine sequence tests, all the previous research would have little or no applicable value.

The NBS has already contracted for engine sequence tests which are scheduled to begin in June 1983. These tests will not be completed until December 1983, well into the FY 84 budget year. At the completion of the tests, NBS must review them, evaluate the results relative to all their previous work and issue the final report. At that time the NBS research on used oil recycled to lubricating oil will be complete, with no need for further funding in FY 1985.

The recycled oil program is unique in that without the completion of the verification studies now underway, past research and developed tests will not be proven and all past funding, almost 8.5 million dollars, will have been wasted. There are no intermediate results in the recycled oil program that provide usable benefits or results that may be applied by industry or the consuming public.

The Association of Petroleum Re-Refiners is in a unique position to ask for this funding. At the outset of the NBS program, the Association, at the expense of its members, provided the NBS with a research associate for almost two years to assist the Bureau in the organization and establishment of its research efforts. Certainly, our member companies would not have gone to that degree of expense if they had foreseen that the research would be terminated prior to its completion; and, unfortunately, the oil recovery industry is made up of small businesses that have neither the capital nor the technical sophistication to complete unfinished NBS research.

For this reason, we are asking that the committee fund the NBS recycled oil program in FY 1984 in the amount of $800,000.

We would also like to bring up another issue for consideration by the committee.

At the completion of the NBS research on recycled oil, the NBS staff with expertise in this area will be disbanded and the expertise, developed over a number of years, dissipated. When that occurs, there will be no centralized federal expertise in this area of recycled oils, which is a waste of developed knowledge, and taxpayer dollars. Certainly the need for federal expertise remains.

The members of the committee are aware of the experience of Times Beach where used oil was laced with dioxin and utilized as a road oil for a dust suppressant. The test for dioxin is extremely complicated, expensive and beyond the financial ability of many small communities to pay for it. The committee may want to consider retaining a level of expertise within the National Bureau of Standards in the area of used oils to be available on a consultant basis. If such a federal source of information and assistance was available, the community of Times Beach, suspecting contamination, could have consulted NBS for help in detecting the presence of dioxin in the road oil.

With this in mind, we respectfully ask the committee to consider maintaining a federal source of expertise in the area of used oil at the National Bureau of Standards on a permanent basis. We understand this could be accomplished for about $200,000 per year.

Thank you for the opportunity to present our comments.

Mr. WALGREN. How much has the program cost thus far?

Mr. McBAIN. Since 1976, it was funded at about $250,000 per year, which would bring it up to about $8.5 million to date.

Mr. WALGREN. Invested thus far?

Mr. McBAIN. Six million invested in the tests that they are working on now in the area of lubricating oil.

Mr. WALGREN. Well, it certianly is an area where we have a lot of the product, and when you see other countries doing—using that product more effectively than we do, we ought to be asking ourselves whether we are bringing the right judgments to bear in that area.

Mr. McBAIN. It is important that we generate in this country 1.2 billion gallons of used oil per year. We are now recycling about 100 million of that.

The rest, some 650 to 700 million gallons is burned in facilities that are not set up to take the used oil with its contaminants and the rest is dumped on the land.

The same as the area, like Times Beach. And these tests that the NBS are working on to determine substantial equivalents will help eliminate things like that; that, plus regulation.

Mr. WALGREN. Would that be a violation of the law for the disposal of those chemicals?

Mr. McBAIN. It is a violation of the law, but the problem in Times Beach, it was sold as a road oil, a recycled use and the people had no idea that there were chemicals in it and that is the problem.

You have to be able to test for it. The testing procedures available to the members of industry, and to the public at large, plus stronger regulation here to eliminate that.

Mr. WALGREN. Do those chemicals get into the oil inadvertantly because of their use, the prior use of the oil?

Mr. McBAIN. That happens sometimes but one of the major problems is people will go out and they will collect used oil and also collect toxic chemicals and mix it, and they can then sell it as a fuel, and the feeling if we have used oil when we mix it, say no more than 10 or 20 percent of these toxic chemicals in used oil, we can burn it and it can go on the road and experience has shown it is harmful.

Mr. WALGREN. Is that illegal disposal of the toxic chemical?

Mr. McBAIN. Yes.

Mr. WALGREN. Their purpose really is to dispose of the toxic chemical at that point?

Mr. McBAIN. Yes, but if you don't have the regulations on the use of the used oil, used oil has been used as a vehicle to carry all types of toxic chemicals, and it contains many heavy metals anyway and when you add other toxic chemicals to it, it becomes much more hazardous.

We are working with Mr. Florio's Committee on Legislation to tighten up the regulations on used oil.

Mr. WALGREN. I see.

Mr. Brown?

Mr. BROWN. Mr. McBain, one of the things we are trying to explore and ascertain is the rationale which leads the administration to make certain budgetary decisions in programs like this and I want to ask you a question about this.

It seems in my mind, if I may say so, that the conduct of research necessary to establish standards is an essential role of Government under any circumstances. What does bother me, however, the fact that in the petroleum industry, you have one of the most powerful, wealthiest and, in fact, concentrated industries in this country.

I am wondering what rationale there is for this industry not conducting the research necessary to reutilize the oil more effectively, in effect, to conserve a fundamental resource that is costing us a lot of money and financial difficulty because so much of it has to be imported.

From your experience, what rationale is there for the industry not doing more to promote and encourage the reuse of petroleum?

Mr. McBAIN. I know we worked very closely with the API and even some of the larger oil companies on promoting the use of reused oil.

Shell, Canada, they are probably one of the largest re-refining facilities at Toronto. It is a test facility. They have taken a lot of risk because if it does not work, a lot of money goes down the drain.

Phillips Petroleum has developed a process, the use of solvents to apply to used oil to come out with a clean fuel that will meet the standards for automotive lubricants.

As far as these particular standards are concerned, API supports the continuance of this work at the NBS, so that the work can be shared by everybody.

As far as we are concerend, when NBS started this program, at the expense of our members which was a fair amount of money to them at that time in 1976, they supplied one full-time research associate stationed at the NBS for 2 years to help them get this program off the ground.

Mr. BROWN. So you are saying that the petroleum industry itself through the API and some of the companies that you have mentioned is actually beginning to do more?

Mr. McBAIN. Yes, they are recognizing this issue as an important issue and support the growth of the re-refining industry.

Mr. BROWN. The problem really is that they have just been rather slow in picking up on this rather than the fact that they are unable or unwilling to do it?

Mr. McBAIN. A few years ago or more than a few years ago, it was not recognized as a need. Now it is recognized by the industry that re-refining is a need in this country.

Just for one example, years ago we had Pennsylvania crude and you could almost put that in your car it was so good. Today we have a lot of imported oil, and it takes more of that imported oil to make a gallon of lubricant than it did with some better crude.

Re-refined oil, of course, is a perfect feedstock for lube. It is clear once it is cleaned, so it is better for our energy independence. It is a resource that we can use over and over again rather than continuing to buy more and more imported crude to make the same amount of lube.

Mr. BROWN. Thank you.

Mr. WALGREN. Thank you, Mr. Brown.

Mr. MacKay.

Mr. MACKAY. Mr. Brown touched on the question I wanted to ask, and I guess I would try to say it in this way. Is an alternative to the administration's proposal that Government get out of it, is a feasible alternative one that would have a partnership where your industry funded a greater proportion of the finalization of this research?

Mr. MCBAIN. I don't think I understood the question. Are you asking that the industry fund a part of the research?

Mr. MACKAY. I think you said that at the outside you had one researcher there.

Mr. MCBAIN. Yes, that is true. At the very beginning we supported the beginning of this research by a full-time research assistant to help get the NBS off the ground and getting the program started.

Certainly our members wouldn't have funded that if they felt the administration wouldn't complete the work.

Mr. MACKAY. But the continuation of that funding, would you see that as an appropriate policy?

Mr. MCBAIN. From the industry?

Mr. MACKAY. Yes.

Mr. MCBAIN. It is probably an appropriate policy, but the re-refining industry is extremely small. It can't afford to continue paying for that, and it is, the benefits of the research don't just help the re-refining industry alone.

It is beneficial to us. It is beneficial to the major oil industry. It is beneficial to the oil-consumer public and to the military and to Government, all Government purchasing as well.

It is basically work, as Mr. Brown said earlier, the work of the Government to do the testing so we can set standards so it affects everybody.

Mr. MACKAY. All right. Thank you.

Mr. WALGREN. Thank you, Mr. McKay.

Well, we appreicate your testimony very much, Mr. McBain. Thank you very much.

Mr. WALGREN. Next we will hear from a panel on the Buildings Research Institute, that panel being made up of Dr. Steven Fenves from the Department of Civil Engineering at Carnegie-Mellon University; he is joined by Rudard Jones from the National Institute of Building Sciences at the University of Illinois, and John Bush, chairman of the Construction Action Council, U.S. Chamber of Commerce.

Your written statements would certainly be made a part of the record. Let me ask you to summarize or outline or communicate to the committee as you feel most effective.

Start in the order I called, Dr. Fenves.

STATEMENT OF STEVEN J. FENVES, PROFESSOR, DEPARTMENT OF CIVIL ENGINEERING, CARNEGIE-MELLON UNIVERSITY, PITTSBURGH, PA.

Dr. FENVES. Congressman Barnes has summarized the nature of the construction industry. Some people have referred to it as diverse, disbursed, detached and discontinuance.

In that kind of a setting, the Organic Act of NBS from 1901 instructing cooperation in the establishment of standard practice incorporated in codes and specifications takes on an added dimension.

We tend to think of codes and specifications primarily as a technical basis for commerce between buyer and seller and as a basis for regulation for the health and safety of the users.

In the construction industry because of this first nature, codes and standards serve essentially as a collective memory. That is the only place where it is recorded what has worked in the past and what has not worked in the past.

The development, promulgation and adoption of standards and codes is a very highly decentralized activity. There are many organizations such as ANSI, ASTM, ASHRAE and others that are engaged in developing standards.

There are four national model code agencies, and eventually there are 50 States, 40,000 local jurisdictions and a hundred Federal agencies which have to legally adopt and enforce these standards.

In this kind of setting, the role of the Center for the Building Technology is really unique; in this great diversion of industries, organizations and individuals, CBT is recognized as the independent and trusted source of nonproprietary technical data and technologies needed for standard decision effort, and for the promulgation and adoption of these standards. This is CBT's primary role.

However, CBT services two other major purposes. It is an organization that is capable of quickly mobilizing staff and resources to respond to crises such as the Kansas City Hyatt Hotel collapse or the Willow Island cooling tower collapse.

The key word is trust. I can't think of a single private agency that would have the access and cooperation of designers, builders, owners, police, and regulatory agencies that would permit the kind of access and the kind of reporting that CBT has produced in these situations.

Again, I want to emphasize that the result of these reports is vitally important.

That is our collective memory of the profession, and right after an incident such as the Kansas City one, every building code organization goes back and reviews their standards, what went wrong, what could be done in the future to alleviate situations of this type.

Whenever that happens, the basic document from which all of these organizations work is the factual report of CBT of what had actually happened.

The second function of CBT is that of serving as a resource to dozens of Federal agencies responsible for construction or construction-related standards.

Because the Federal Government is such a prominant owner and user of buildings, the role of CBT in these kinds of activities is a very high leverage. The kind of work that was done on instrumenting a Federal building such as the Norris Cotton Federal Office Building has had a tremendous impact because of the very high visibility of the Federal Government as an owner of buildings.

As a measure of the international stature of the Center for Building Technology, Dr. Richard Wright, the director of the center, has just been nominated as the next president of CIB, the international organization for the dissemination of research, building research results.

Congressman Barnes also addressed the question of whether the functions of CBT can be turned over to the private sector. If CBT were another Federal regulatory agency promulgating additional regulations and additional mandates, certainly we should talk seriously about abolishing it.

However, CBT serves exactly the opposite. It is a source of unbiased technical information, and it is, therefore, making a significant contribution to national efforts to remove disincentives in the construction industry.

The second question that one has to raise in the concerns with privatization is what segment of the private sector would take over the functions of CBT.

Admittedly, there are many private sector organizations, universities, laboratories maintained by trade organizations, independent laboratories, and they all supply and add to the pool of knowledge that feeds the standards development process.

All of these organizations are making significant contributions, but they don't have the charter or the track record of acceptance that CBT has, and I think we would run into an enormous amount of acrimony and distrust if this single trust were removed and got into battles as to show technical work is to be accepted in the standards process.

I have served six years, the mandatory maximum, on the NRC Evaluation Panel to CBT. I would be remiss if I didn't point out that the panels over the years have looked very carefully at CBT's programs and activities and have continually urged CBT to sharpen its role in the process.

If your committee were to go through the annual panel reports, you would find many comments where committee members have felt that certain activities could be better done elsewhere and that they did not respond to CBT's role. The committees also have over the years expressed their concern that too large a fraction of CBT's budget comes from other agencies rather than from direct congressional appropriations, and again, the panel reports can be consulted on that issue.

In summary, I have tried to describe CBT's unique role in this very diverse industry that we operate, and the more national need for continued authorization. Rationale can be made for increasing that authorization over the present level.

Two issues that fall very directly into the province of CBT. Several years ago, the GAO published a report on a lack of computer-aided design in the building industry and the disincentives there and pointed out that one of the major disincentives today is that the courts still accept only drawn plans and printed specifications as the legal bidding document.

The courts do not recognize yet that 90 percent of the information that is displayed on those drawings and specifications have been generated by computer programs used by designers, and the first thing that the contractors have to do is to hire quantitative people to redigitize that information to feed it to their estimating and bidding programs.

Clearly, the day has to be reached where computer readable data can be exchanged between designers and builders but in order to do that, we need standards of reader exchange.

That is an activity that would have a tremendous boost to the construction industry. Many experts in the field say that 20 to 30 percent of the cost overruns on construction and legal problems arising in construction arise simply from errors in transcription of data between the designers and the contractors.

You can't open any trade magazine today without seeing pages and pages of ads for various computer processers, microprocessors designed for a small engineering and contracting firm.

It is strictly a buyer's market. There are no clear-cut criteria where the quality, reliability and performance to the applicable codes can be ascertained.

Again, I think there is a need for a major development of measurement and evaluation procedures where these programs could be measured and evaluated and made more attractive to the users.

That is the gist of my comments. I will turn it over to my colleague, Mr. Jones.

[The prepared statement of Dr. Fenves follows:]

STATEMENT BY DR. STEVEN J. FENVES
CARNEGIE-MELLON UNIVERSITY
PITTSBURGH, PA

BEFORE THE
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY
US HOUSE OF REPRESENTATIVES
FEBRUARY 17, 1983

Mr. Chairman and Members of the Subcommittee:

INTRODUCTION

It is an honor to appear again before your Subcommittee. I last testified in March 1981 in connection with the FEMA authorization for Earthquake Preparedness. Today, I want to address the National Bureau of Standards authorization, and specifically the authorization for the Center for Building Technology (CBT) within the Bureau.

First, a statement about my qualifications. I am a University Professor of Civil Engineering and Director of the Design Research Center at Carnegie-Mellon University, in Pittsburgh, PA. In my research, teaching and consulting over 25 years I have primarily dealt with issues of computer-aided design in civil engineering, which has involved collecting and generalizing analytical and practical knowledge and "packaging" this knowledge into computer programs for professional use.

Over the last ten years, I have had close contact with the Center for Building Technology in the following forms:

- six years on the National Research Council Evaluation Panel on Building Technology;
- a summer spent at CBT as Visiting Senior Research Engineer;
- a joint research project with CBT personnel, sponsored by the National Science Foundation;
- over a dozen reports and papers coauthored with CBT staff; and
- research grants and consulting assignments from CBT.

NATURE OF THE CONSTRUCTION INDUSTRY

Your Committee is well aware of the nature of the construction industry. The aggregate industry accounts for approximately $250 billion, or 8% of the GNP. The industry consists of approximately 1,000 construction material manufacturers, 250,000 construction firms, 4,000,000 construction workers, 75,000 engineering and architectural firms, and 40,000 government jurisdictions exercising some form of regulatory power over buildings and construction. The industry has been rightly characterized as "diverse, dispersed, detached and discontinuous".

In such a highly decentralized setting, the need for "cooperation ... in the establishment of standard practices, incorporated in codes and specifications" [quote from NBS Organic Act, 1901] takes on an increased dimension. Codes, specifications and standards traditionally provide the technical basis for commerce between buyer and seller and for regulations that insure the health and safety of users. In the construction industry, they also provide the only "collective memory", in terms of the products and practices that experience and research have shown to result in a safe and economic built environment.

It should not come as a surprise that the development, promulgation and adoption of standards and codes are also highly decentralized. Development of voluntary national consensus standards is largely a private sector activity: organizations such as ANSI, ASTM, NFPA and ASHRAE are engaged in this activity. The promulgation of model building codes is primarily the responsibility of the four national model code organizations. The eventual adoption of these codes and the standards they reference is the legal responsibility of the 50 states, 40,000 local governments and over 100 Federal agencies having construction regulation or oversight responsibility.

THE ROLE OF CBT

The preceding capsule characterization of the industry serves to introduce CBT's unique role in the construction industry. In this disparate collection of industries, agencies, organizations and individuals, CBT is universally recognized as an independent and trusted source of non-proprietary technical data, procedures and measurement technologies vital to the voluntary standardization activities, and to the promulgation and adoption activities that ensue. In this respect, CBT is truly a national resource, and it is in the national interest that the CBT authorization be continued on the basis of this function alone.

The assembled technical skills and expertise of the CBT staff provide two additional unique services to the Nation.

First, CBT is capable of quickly mobilizing staff and resources to mount comprehensive investigations of major failures, such as those of the Kansas City

Hyatt Hotel walkway or of the Willow Island, WV, cooling tower. The key word, again, is trust: CBT staff receives cooperation from local agencies, owners, designers and contractors because of CBT's charter and reputation as a neutral agency interested in ascertaining the facts. Furthermore, the industry depends on CBT to make public the technical causes of failure, and thus to augment the "collective memory" referred to previously. Without such investigations, the facts are tied up for years in litigation or suppressed forever in consent decrees, and neither the industry nor the public it serves learn anything from a failure.

Second, CBT serves as a resource to dozens of Federal agencies responsible for construction or construction-related standards. Because of the prominence of the Federal government as owner and user of buildings, the participation of CBT in such cooperative projects has a very high "leverage"; as a single example, CBT's work on energy efficiency measurement and monitoring of the Norris Cotton Federal Office Building has received wide publicity, and has prompted many private and public owners of buildings to develop similar conservation measures.

WHY A FEDERAL ROLE

The question before your Subcommittee is whether the functions of CBT can be turned over to the private sector. If CBT were another Federal regulatory agency issuing construction-related regulations and mandates, I would certainly argue for its abolition. However, as I have attempted to indicate previously, CBT is exactly the opposite. It is a nationally recognized unbiased source of technical information and measurement technology serving the voluntary consensus standard development process, and thereby making significant contributions to national efforts to remove disincentives in the construction industry. Thus, the issue is not of the "Feds" vs. the rest of American society, but that of a Federal agency acting on behalf of the Nation as a whole in providing knowledge to the benefit of all segments of society.

Furthermore, in the disaggregated condition of the construction industry, the question arises as to what segment of the private sector could provide the functions now provided by CBT. Admittedly, private sector organizations, including Universities, industrial laboratories and laboratories sponsored by trade organizations all contribute significantly to the pool of knowledge that supplies the standards development process. But none of these significant contributors have the charter, the track record and the acceptance that CBT has. The acrimony and distrust created by the removal of the one impartial organization would be as burdensome and counterproductive as the most regressive and unnecessary construction regulation.

CBT PROGRAMS

As a former member of the NRC Evaluation Panel, I would be remiss if I did not point out that the successive panels have not universally endorsed all of CBT's programs and activities. The Panel has continuously advised CBT to define its unique role and to de-emphasize or drop programs that could be better done elsewhere. The annual panel reports may be consulted for specifics, and for CBT's responses to these critiques.

The Panel has also, on occasion, criticized some of the policies of NBS management with respect to CBT's role. I, as an individual, have deplored NBS's occasional narrow definition of CBT's technical role, and the de-emphasis of CBT's activities in studying the human behavioral aspects of the built environment and in developing economic measures of standards and regulations.

Finally, the Panel has repeatedly expressed its concern over the budgetary imbalance between CBT's direct appropriation funds and external from other Federal agencies. This ratio has been round 30%-70% in the past years. The Panel has felt that stability and continuity of the Center's programs require that a higher share of CBT's funds come from direct appropriations.

SUMMARY

Mr. Chairman, I have attempted to describe CBT's unique role in the construction standardization process, and of the important national need for the continued authorization of CBT.

I believe that a strong rationale can be made for increasing CBT's authorization beyond its present level. I will take only a minute to describe two activities where CBT's technical input can have a very high payoff at a national scale. Both of these have to do with the increasing role of computers in construction.

First, one of the major disincentives in public, competitive bid construction is that legally only the printed specifications and the plans drawn on paper constitute the bid documents. Today, the plans and specifications are generated by designers' computer programs from computer-generated data, and the contractors' estimating programs need the same data as input. A major increase in construction efficiency could be achieved if such data could also be transmitted in computer processable form. To do this, technical standards for data exchange are needed.

Second, on a broader scale, computer programs for a wide variety of construction-related applications are appearing on the marketplace. The individual engineer or contractor is hard pressed to evaluate such programs for features such as correctness, completeness, conformance to applicable codes and standards, etc.

Both of these areas are direct extensions of CBT's traditional role of providing technical bases for standardization and evaluation methodologies.

Mr. Chairman, thank you for your attention. I will be pleased to answer any questions from the members of the Subcommittee.

STATEMENT OF RUDARD A. JONES, FAIA, NATIONAL INSTITUTE OF BUILDING SCIENCES, WASHINGTON, D.C.

Mr. JONES. Mr. Chairman, and members of the subcommittee, by way of introduction, my name is Rudard Jones. I am a research professor emeritus at the Department of Architecture at the University of Illinois and a former colleague of Steve Fenves.

Formerly, I directed the University of Illinois Small Homes Council, Building Research Council. I have served as president of the American Society for Testing and Materials and as a member of the Building Research Advisory Board in the National Research Council.

I am a member of the Board of Directors of the National Institute of Building Sciences and have been since its inception in 1976. It is in this capacity that I appear before you today.

As I am sure you know, NIBS was authorized by the Congress as part of the Housing and Community Development Act of 1974. This authorizing legislation, section 809 of Public Law 93-383, provides a role for NIBS, both in advising the public and private sectors of the economy on the use of building science and technology, and in assigning and delegating roles essential to the realization of a more rational housing and building regulatory environment and a more effective system for the introduction of housing and building technology.

These general roles, plus more specific charges in the legislation, indicate that NIBS also has a responsibility to assess, evaluate, and make recommendations to all Federal agencies, including the National Bureau of Standards, concerning the scope and direction of their respective programs that impact on the Institute's mission.

It was in consideration of these obligations that, upon learning of the administration's proposal in the fiscal year 1984 budget to eliminate the Center for Building Technology and the Center for Fire Research, the NIBS Board of Directors, on Feb. 17, 1983, adopted a resolution recommending the continuance of an appropriate level of funding for these Bureau operations.

However, in doing so, the NIBS Board also recommended that the CBT and CFR programs and program objectives be carefully evaluated by an outside body with respect to the needs and concerns of the building community. A copy of the formal NIBS Board of Directors' resolution on this matter is attached.

The following excerpt from that resolution states the essence of the NIBS position:

> NIBS urges that CBT and CFR be continued with a sufficient budget to carry out their respective basic research missions. It does so with the caveat that provisions be made for greater industry involvement in the determination of CBT and CFR programs and in the review of the quality and utility of their work, and that these provisions do not involve compliance with the Advisory Committee Act.

Why should the CBT and CFR be continued? Basically, they should be continued because they are doing valuable work which can best be accomplished under Government sponsorship.

In establishing the National Bureau of Standards, the Congress recognized that there is a leadership role for Government to play in fostering scientific research, particularly the science of measurement.

The work conducted by the Bureau in the areas of building and fire technology has long had an impact on the building community, including the voluntary standards system related to building products and practices.

Fundamental information and data gathered by CBT and CFR is often used by standards-making organizations in developing new, and in revising existing, building standards. Such standards may, in turn, be referenced by model code bodies and regulatory authorities to control the physical properties and/or performance characteristics of products, materials, processes, or services that are incorporated into buildings.

It should be recognized that the system for developing building standards in the United States is characterized by two important features—it is largely voluntary and it is highly fragmented and decentralized.

You heard much more about this earlier.

In this respect, much of the work conducted by CBT and CFR has been very useful. The fact is, these kinds of research generally are not performed within the private sector.

In summary, the National Institute of Building Sciences would like to see funds restored at both CBT and CFR. Specifically, at CBT, fundamental work should continue in: structural engineering, construction safety, thermal analysis, mechanical systems and controls, basic building materials; and at CFR in fire risk analysis, fire safety performance, suppression and extinguishment, smoke and toxic gases, fire toxicology, fire properties of materials.

You may ask why, in its resolution of support for CBT and CFR, why did NIBS add the caveat asking for wider industry participation in the development of their programs?

Very simply, we believe we are required by law to make any recommendations which we judge will better the building community for the benefit of the public. We also believe that such wide industry participation can best be accomplished through NIBS because it is organized and constituted to bring together all the facets of the building community.

In conclusion, the Institute appreciates this opportunity to make its views known on the proposed budget cuts; it supports a role for the Bureau of Standards in building and fire technology, but it also believes the Nation will be best served if there is broadly based building community input to the programs of CBT and CFR.

I will be happy to answer any questions you may have.
[The prepared statement of Mr. Jones follows:]

A Statement By

Rudard A. Jones, FAIA

Mr. Chairman, members of the subcommittee, my name is Rudard A. Jones, FAIA. I am a research professor emeritus in the Department of Architecture at the University of Illinois at Urbana. Formerly, I directed the University of Illinois Small Homes Council. I have served as President of the American Society for Testing and Materials (ASTM) and as a member of the Building Research Advisory Board (BRAB). I am also a member of the Board of Directors of the National Institute of Building Sciences (NIBS) and it is in this capacity that I appear before you today.

As I am sure you know, NIBS was authorized by the Congress as part of the Housing and Community Development Act of 1974. This authorizing legislation, Section 809 of P.L. 93-383, provides a role for NIBS both in advising the public and private sectors of the economy on the use of building science and technology, and in assigning and delegating needed activities essential to the realization of its mandated mission of bringing about a more rational housing and building regulatory environment and facilitating the introduction of technology.

NIBS was to concern itself with the roles of private organizations, institutions, and agencies, and with Federal and other governmental entities that could help in these efforts. Since NIBS became operational with its first Congressional appropriation in late 1977, it has been involved in a number of meetings and exchanges regarding the plans and programs of the National Bureau of Standards. Quite separately, I have personally participated on several of the Bureau's evaluation panels--specifically those concerned with the work of the Center for Building Technology.

I would like to point out that there are similarities between the mission of the National Institute of Building Sciences and that pursued by the Center for Building Technology (CBT). The purpose of CBT, as stated in its annual project summaries, is "to increase the usefulness, safety, and economy of buildings through the advancement of building technology and its application to the improvement of building practice." CBT's programs address building construction productivity, structural and geotechnical engineering, building materials, building physics, and building equipment. The charge given by the Congress to the National Institute of Building Sciences is similar in that it includes: "(A) Development, promulgation, and maintenance of nationally recognized performance criteria, standards, and other technical provisions for the maintenance of life, safety, health, and public welfare... including test methods and other evaluative techniques relating to building systems, subsystems, components, products, and materials with due regard for consumer problems; (B) Evaluation and prequalification of existing and new building technology...; (C) Conduct of needed investigations in direct support of (A) and (B) above; (D) Assembly, storage, and dissemination of technical data and other information directly related to the above."

This similarity of missions and the fact that NIBS has legislative responsibility to assess, evaluate and make recommendations to all Federal agencies, including the National Bureau of Standards, concerning the scope and direction of their programs that impact upon the Institute's mission, leads me to suggest that this subcommittee take advantage of the opportunity presented by these hearings to ensure qualified and authoritative input to the planning of work to be undertaken by both the Center for Building Technology and the Center for Fire Research (CFR). The comments and concerns you have heard during these hearings reflect the fact that the CBT and CFR conduct many important investigations and produce data that are potentially useful to the building community. You have also learned that there is a considerable amount of work undertaken by the Bureau on its own initiative without the opportunity for private-sector--or, for that matter--other governmental agency input as to need, priority, or possible overlap or duplication. Congress appears to have anticipated situations such as this when it authorized the creation of NIBS and assigned to it a coordinating and evaluating role in building science and technology and its application. Unfortunately, NBS has not looked to NIBS as a resource for technical guidance. We at NIBS have been unsuccessful in our attempts to make substantive input to the direction of the CBT and CFR work programs.

In consideration of the Administration's proposals for fiscal 1984 in the NBS budget that would eliminate CBT and CFR, the NIBS' Board of Directors, on February 17, 1983, adopted a resolution recommending the restoration of all or part of the planned 1984 expenditure in these areas. However, the Board also recommends that the CBT and CFR programs and program objectives be carefully evaluated by an outside body with respect to the needs and concerns of the building community. A copy of the formal NIBS' Board of Directors opinion on this matter is attached.

The composition of the building community in this country, comprised as it is of thousands of small businesses and special interest groups, is highly competitive, yet most of these small entities have very limited resources to invest in basic research and development activities. The development of new technology within our industry tends to be concentrated in the large building material and product producers. This private sector research is largely proprietary, somewhat disorganized, and frequently geared to short- or mid-term objectives. This is not to say that the building industry is devoid of innovative talent and scientific expertise. The real problem is one of availability and distribution of financial resources. In establishing the National Bureau of Standards the Congress recognized that there is a leadership role for government to play in fostering scientific research, particularly the science of measurement.

The work conducted by the Bureau in the areas of building and fire technology has long had an impact on the building community, including the voluntary standards system related to building products and practices. Fundamental information and data gathered by CBT and CFR is often used by standards-making organizations in developing new and revising existing building standards. Such standards may, in turn, be referenced by model code groups and regulatory bodies to control the physical properties and/or performance characteristics of products, materials, processes, or services that are incorporated into buildings. It should be recognized that the system for developing building standards in the United States is characterized by two important features; it is largely voluntary and it is highly fragmented and decentralized. In this regard, much of the work conducted by CBT and CFR has been useful.

The Enabling Act of the National Bureau of Standards authorizes the following functions:

- "cooperation with other governmental agencies and with private organizations in the establishment of standard practices, incorporated in codes and specifications,
- the development of methods for testing materials, mechanisms, and structures, and the testing of materials, supplies and equipment, and
- advisory service to government agencies on scientific and technical problems."

Other legislative mandates exist which cite NBS/CBT responsibility to develop improved building practices, including:

- P.L. 95-124, Earthquake Hazards Reduction Act of 1977,
- P.L. 94-385, Energy Conservation and Production Act,
- P.L. 94-163, Energy Policy and Conservation Act,
- P.L. 94-409, Solar Heating and Cooling Demonstration Act of 1974,
- P.L. 93-498, Federal Fire Protection and Control Act of 1974,
- P.L. 95-617, The National Energy Act.

In addition, Memoranda of Understanding exist between NBS and HUD, DOE, NSF, OSHA, and the National Conference of States on Building Codes and Standards (NCSBCS) which, incidentally, is not a governmental body. These memoranda have been executed in the interest of cooperation and joint program planning to avoid duplication of program effort.

However, the Bureau has chosen not to enter into a Memorandum of Understanding with NIBS to facilitate cooperation and coordinated building community input even though we have proposed such a mechanism on several occasions. We would be happy to provide the subcommittee with a copy of this draft document.

In summary, the National Institute of Building Sciences would like to see funds restored at both CBT and CFR. At CBT, fundamental work should continue in the areas of:

- structural engineering
- construction safety
- thermal analysis
- mechanical systems and controls
- basic building materials

At the Center for Fire Research, similar work should continue in:

- Fire Risk Analysis
- Fire Safety Performance

- Suppression & Extinguishment
- Smoke & Toxic Gases
- Fire Toxicology
- Fire-Properties of Materials

At a minimum, we would hope the subcommittee would take the following actions:

1) Call upon the National Bureau of Standards to enter into a Memorandum of Understanding with the National Institute of Building Sciences that will ensure a mechanism for building community input to, and constructive critique of, projects within the Center for Building Technology and the Center for Fire Research as they affect housing and building, and
2) Call upon the National Bureau of Standards to seek the assistance of the National Institute of Building Sciences in evaluating the missions and current programs of CBT and CFR with respect to the research needs of the building community.

We also would hope that the subcommittee would request that a copy of the executed Memorandum of Understanding be submitted for the record and for future reference. For its part, I can assure you that NIBS is prepared to provide prompt, objective, and well balanced recommendations on CBT and CFR to the Director of the Bureau, the Secretary of Commerce, and the members of this subcommittee.

The Institute appreciates this opportunity to make its views known on the proposed budget cuts. NIBS supports a role for the Bureau of Standards in building and fire technology, but it also believes the nation will be best served if there is broadly based building community input to the programs within CBT and CFR.

I will be happy to answer any questions you may have.

Attachment

POSITION OF THE NATIONAL INSTITUTE OF BUILDING SCIENCES (NIBS) REGARDING THE FY 1984 BUDGETS OF THE CENTER FOR BUILDING TECHNOLGY AND CENTER FOR FIRE RESEARCH

The Department of Commerce has proposed the complete phasing out of the Center for Building Technology (CBT) and the Center for Fire Research (CFR) within the National Bureau of Standards. The National Institute of Building Sciences believes that elimination of these centers would not be wise; rather, the missions and scope of activities of CBT and CFR should be carefully evaluated with respect to the legitimate concerns of the building community.

The United States government already spends less per capita on building research than governments of other developed nations. Less is spent by the Federal government on research in building than in most other industries, despite the fact that construction represents a significant proportion of the Gross National Product and that almost 70% of the nation's wealth is represented by the value of constructed facilities. Of even greater importance is the fact that the fragmented nature of the construction industry makes it extremely difficult for the industry to conduct basic research. Indeed, such research will not be accomplished in the absence of a Federal effort. It is this research that can have meaningful impact on reducing life and property losses due to fire in a nation which leads the world in fire loss, help promote innovative technology, and help prevent deterioration of the infrastructure of our built environment.

Therefore, NIBS urges that CBT and CFR be continued with a sufficient budget to carry out their respective basic research missions. It does so with the caveat that provisions be made for greater industry involvement in the determination of CBT and CFR programs and in the review of the quality and utility of their work, and that these provisions do not involve compliance with the Advisory Committee Act.

The Congress of the United States, in passing Public Law 93-383 in 1974, found that there was need for an authoritative national source to advise both the public and private sectors of the economy with respect to the use of building science and technology. The Congress then established the National Institute of Building Sciences (NIBS) to be that source and called upon NIBS "to assign and delegate -- to the maximum extent possible -- responsibility for conducting needed activities.... to one or more of the private organizations, institutions, agencies, and Federal or other governmental entities with a capacity to exercise or contribute to the exercise of such responsibility, monitor the performance achieved through assignment and delegation, and, when deemed necessary, reassign and delegate such responsibility."

In recognition of this charge, the Congress should call upon and provide adequate funds for the National Institute of Building Sciences to evaluate the missions and current programs of CBT and CFR with respect to the research needs of the building community and to make recommendations to the Secretary of Commerce and the Congress as to an appropriate research agenda for these centers.

APPROVED FEBRUARY 17, 1983

BOARD OF DIRECTORS

Mr. WALGREN. Thank you, Mr. Jones.
Mr. Bush.

STATEMENT OF JOHN S. BUSH, JR., CHAIRMAN, CONSTRUCTION ACTION COUNCIL, U.S. CHAMBER OF COMMERCE, WASHINGTON, D.C., ACCOMPANIED BY WILLIAM D. KELLEHER, DIRECTOR, COMMUNITY AND REGIONAL DEVELOPMENT, U.S. CHAMBER OF COMMERCE

Mr. BUSH. Mr. Chairman, members of the subcommittee, thank you for allowing us to be here. With me is Bill Kelleher, staff director of the U.S. Chamber of Commerce.

This boils down to two pretty simple questions. The first question is, are these centers doing something worthwhile for the American people.

Then, the second question is, if so, and if they are eliminated, can private laboratories be expected to perform these worthwhile activities as would be contended in the administration's budget proposal.

I went out to a number of directors of research of large private laboratories across the United States and asked them these two questions. Their answer to the first question is yes, these centers are performing worthwhile functions.

The answer to the second question, and I must say they were unanimous in their answers on both of these questions, was no, it is not economically feasible to replace the activities of these centers with private laboratories because the testing techniques which are devised by the centers usually require production of only a very few testing devices which are later sold to perform these tests, and there are so few of these sales that not enough money can be generated to pay for the developmental research to develop the tests in the first place, so this is the reason private industry would not replace these functions.

We give examples in our testimony of recent accomplishments of both the Center for Building Technology and the Center for Fire Research, but I had a very vivid experience on this about 3 years ago that I would like to briefly relate.

The Federal Trade Commission ordered that the thermal insulation industry label its products in such a manner as to exactly what the thermal efficiency of these products was.

There was no test available to determine whether the products indeed achieve this level of thermal efficiency. So the only alternative we as insulation manufacturers had was to build about a 15-percent surplus into all of our products, so that we were assured of meeting the labeling requirement.

This would have cost industry $90 million per year to build this additional 15 percent in which would have been passed on, of course, had to be, to the consumer.

We were able to get the Federal Trade Commission to hold off for 1 year until the National Bureau of Standards, Center for Building Technology, created the test which was practical and which we are now using.

There was no other place to turn for this kind of test, and nobody else would have had the credibility to establish such a test.

I think it is important to realize that construction is either our No. 1, or 2 largest industry in the United States. It accounts for 10 percent of our gross national product, but this is an astonishing fact, 70 percent of our wealth in the United States is in buildings which shelter our social, economic, and political activities.

The Center for Building Technology through its field work, laboratory experiments, and analytical research provides the basic knowledge of the properties and operations of entire buildings in various building materials and systems and components. Without this basic knowledge, that cannot be obtained through proprietary research and development.

Responsible and cost-effective decisions cannot be made in construction. So far as the Center for Fire Research is concerned, the need for the Center today is as great as it was when it was established in 1974.

The United States continues to lead the industrial world in the number of lives lost to fires and the increasing complexity of building materials makes further research vital.

The Center offers unique research facilities that deal with the highly specialized issues involved in fire research. It is extremely unlikely that any private sector institution could or would step in to provide either the equipment or interdisciplinary approach needed to address this problem.

The Nation faces numerous challenges in the construction industry in the next 10 years. We must house the new families emerging from the baby-boom generation, rebuild our infrastructure and construct modern plants to restore economic vitality and provide jobs.

The innovative work done by both these Centers can make important contributions to meeting the technological challenges in all these areas.

We urge you to support reauthorization of the Center for Building Technology and the Center for Fire Research. They have proven records of accomplishments and offer unique facilities and perspectives that cannot be replicated by the private sector.

[The prepared statement of Mr. Bush follows:]

Chamber of Commerce of the United States of America
Washington

STATEMENT
on
REAUTHORIZATION
of the
CENTER FOR BUILDING TECHNOLOGY
and the
CENTER FOR FIRE RESEARCH
before the
SUBCOMMITTEE ON SCIENCE, TECHNOLOGY AND SPACE
of the
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
for the
CHAMBER OF COMMERCE OF THE UNITED STATES
by
John S. Bush, Jr.
March 23, 1983

I am John S. Bush, Jr., Vice President, Government Affairs with the U.S. Gypsum Company. Accompanying me is William D. Kelleher, Director Community and Regional Development, Chamber of Commerce of the United States. My appearance today is on behalf of the Chamber, where I serve on the Construction Action Council as Chairman of its Building Technology Executives Group. The U.S. Chamber of Commerce is the nation's largest business organization with a membership of 226,000 consisting of business firms, local, state and regional chambers of commerce, and trade and professional associations.

The U.S. Chamber supports reauthorization of the Center for Building Technology (CBT) and the Center for Fire Research (CFR) within the National Bureau of Standards. Continuation of both these organizations is vital to the entire construction community. They provide unique research capabilities and perspectives which cannot be duplicated in the private sector.

Center for Building Technology

The Center for Building Technology has undertaken a wide range of activities resulting in improvements in construction technology and the enhancing of the operation of the construction market place to the advantage of both industry and the consumer. Among the numerous accomplishments of the Center, I would specifically like to highlight the following:

- CBT developed a method for obtaining measured calibrated transfer specimens for use in conjunction with "the representative thickness" provision of the Federal Trade Commission (FTC) Labeling and Advertising of Home Insulation Rule. Test data and documentation were developed by CBT. This could not have been accomplished by private industry within the time limits prescribed by FTC. If the insulation industry had to comply with the FTC rule as written before the development of the guarded hot plate by CBT, increased costs for compliance, which would have been passed on to the consumer, were estimated to be $90 million per year.
- Conducted comprehensive investigation of the 1981 walkway collapse in Kansas City resulting in improved design and construction procedures.
- Developed performance criteria and test methods for protection of reinforcing bars in concrete salt-induced corrosion which will assist in more efficient bridge construction.
- At the suggestion of the American Society for Testing and Materials and the American Association of State Highway and Transportation Officials, CBT developed test equipment and procedure so that approximately 580 public and private laboratories across the country could conduct quality assurance testing for buildings and transportation facilities.

Construction is one of the nation's largest industries. It is estimated to account for 10 percent of our Gross National Product and 69 percent of our nation's wealth consists of the facilities that have been built to support and shelter all our social, economic and political activity. The CBT, through its field work, laboratory experiments and analytical research, provides the basic knowledge on the properties and operations of entire buildings and various building materials, systems and components. Without this basic knowledge which cannot be obtained through proprietary research and development, responsible and cost effective decisions cannot be made in construction.

The construction community is a highly diverse group consisting of building owners, manufacturers, designers, financers, developers, contractors, research and testing laboratories, standards developing organizations, regulatory bodies and federal, state and local governments. The CBT is a necessary institution within this community because it provides an objective and impartial source of information and research to all those who design, finance, build, operate and use our facilities.

The Center for Fire Research

The need for the Center for Fire Research remains as valid today as when it was established in 1974. The United States continues to lead the industrial world in the number of lives lost to fires and the increasing complexity of building materials and building contents make further research vital. CFR offers unique research facilities that deal with the highly specialized issues involved in fire research. It is extremely unlikely that any private sector institution could or would step in to provide either the equipment or interdisciplinary approach needed to address this problem.

Specific examples of the contributions by the Center follow.

- The National Bureau of Standards (NBS) Center for Fire Research (CFR) has been the guiding force in the development of testing equipment to quantify characteristics of materials which have been subject to fire. Once these characteristics have been quantified, a user of a material could rank order materials associated with the use of various products. Specific examples of standards researched by CFR in this area are:

    - ASTM Standard E 136 is a frequently used standard to describe combustibility of materials. The furnace used for this evaluation was developed by NBS/CFR.

    - ASTM Standard E 662 is used to describe the smoke-producing characteristics of a building material. This equipment was developed by NBS/CFR.

  - ASTM Standard E 162 and E 648 are used to describe flame spread characteristics of building material. Again, NBS/CFR led in the development of the equipment to evaluate these characteristics.

- CFR has developed a major program for fire protection methods in high-rise buildings which are vitally needed in light of the MGM Grand Hotel fire in Las Vegas. Specific work has been and is being done on sprinklers, smoke control, smoke detection and building design.

- The Center is the principal laboratory for the development of new test methods for flame spread and heat release which are necessary to cope with the very different burning behavior of plastics and other materials.

- CFR is the major developer of computer-based fire simulation models needed to estimate the impact of new materials and methods subject to fires.

National Voluntary Laboratory Accreditation Program (NVLAP)

While not part of this authorization bill, we also want to express our continued support for the National Voluntary Laboratory Accreditation Program (NVLAP). An efficient and effective system of testing laboratories is necessary for the practical application of improved product standards. We urge you to support adequate funding for the NVLAP program so that the knowledge produced by organizations, such as the Center for Building Technology and the Center for Fire Research, can be used in the field.

Conclusion

The nation faces numerous challenges in the construction industry in the next ten years. We must house the new families emerging from the baby-boom generation, rebuild our infrastructure and construct modern plants to restore economic vitality and provide jobs. The innovative work done by both these Centers can make important contributions to meeting the technological challenges in all these areas.

We urge you to support reauthorization of the Center for Building Technology and the Center for Fire Research. They have proven records of accomplishments and offer unique facilities and perspectives that cannot be replicated by the private sector.

Mr. **Walgren**. Thank you very much, Mr. Bush. We certainly appreciate the chamber's view in this area especially.

Let me return to Dr. Fenves, and I was interested in your testimony where you were saying that as an individual, your role on various boards and the like, you had argued against the narrow definition of the Center for Building Technology's role, in particular with respect to human behavioral aspects of the buildings, and I am just interested in that.

Could you elaborate on that a little bit? How have they confined themselves; and do you see potential that would be worth reaching for in areas that they have not gone into?

Dr. **Fenves**. Probably Professor Jones is more qualified to speak on the technical issues than I. He is an architect. I am an engineer, but it seemed to me that the issues such as stairways, safety of people in buildings, behavior of people in buildings in emergencies, there were a number of human behavior issues that the architectural research sections of the Bureau worked on at one time and to me as a layman in the field, came up with very interesting results, and as an individual, I felt that that was an integral part of building technology research, and I was unhappy when those programs of the Center were terminated.

Mr. **Walgren**. Were they terminated because of the Bureau of Standard's management role over the Center or were they terminated internally within the Center?

Dr. **Fenves**. My understanding is that they were terminated by the Bureau of Management as not fitting within the definition of techological bases for standards and standards development.

Mr. **Walgren**. I certainly, as a matter of personal interest, would be curious about areas that you feel the Center should be involved in, that they have been restricted from, and perhaps you might just add something along that line in writing just for our own information and for the purposes of the record, because I think it is important that we understand the potential of these efforts, as much as we possibly can in the process of thinking about their funding so I would be curious about that.

Dr. **Fenves**. OK.

Mr. **Walgren**. Mr. Jones, I wanted to ask what your experience has been with the reluctance of the Bureau of Standards to enter into formal input relationships with the NBIS, if that is the right sequence of letters? NIBS, excuse me.

You mentioned in your testimony that the Bureau has formal documents of understanding of their relationship to other agencies, HUD, DOE, the National Science Foundation, and yet even though the NIBS was specifically set up by the Congress to play a coordinating role in the area of building technology, they have apparently held themselves at more than a distance from that organization.

Could you elaborate on that for me?

Mr. **Jones**. I wouldn't want to leave the impression that there has not been a great deal of cooperation between NIBS and CBT, because there has been, and we have worked together on many things.

You are referring to probably a memorandum of understanding or some such statement such as that, a formal statement, and we were invited at one time by the Bureau or the CBT to prepare such a statement, and did submit one to them, but as of the moment this has not been completed, or it seems to be at a standstill.

Now, I have not been a part of those negotiations, so I can't tell you exactly why this has not transpired, but we think it would be useful.

Mr. **Walgren**. Certainly we have a real obligation not to duplicate services in this goverment, and the committee would be very interested in what that relationship is, and why it has been limited, if it has been limited.

Your testimony does attach a memorandum, I believe, sir.

Mr. **Jones**. I believe it says that we would be happy to furnish a copy.

Mr. **Walgren**. Well, the committee would be interested in that, and if you would do that, we would be most appreciative, (see NIBS letter of April 12, 1983) and we would like certainly to talk to the parties involved about why or what the scope of coordination is. From your perspective in the NIBS, are there particular areas that you would want to see the Center for Building Technology pursue that they are not pursuing at this point or are we not quite on that level in our views that can be presented for the record at this point?

Mr. **Jones**. Well, anything that I would present to you now would be personal, so I don't think it is appropriate at this time when I am representing the other.

I would certainly support personally as an architect a continuation of the, or a restarting of the investigation in human behavior.

I have had quite an interest in that subject, and in fact in a small way we did some of that work at the University of Illinois, and it is a very difficult thing to get a grasp on, but it is quite vital. In the bettering of buildings, it is quite vital.

Mr. **Walgren**. When was that terminated, the human behavior efforts?

Mr. **Jones**. It was about 3 years ago, I would think.

Dr. **Fenves**. I would guess 3 or 4 years.

Mr. **Walgren**. Was that a major effort that involved a lot of money?

Mr. **Jones**. I don't know the budgeting on it.

Dr. **Fenves**. I would guess less than a fifth of the staff of CBT.

Mr. **Jones**. That encompasses studies of lighting. It encompasses actual human behavior in a house, which was my primary concern.

There was a very interesting study they were working on on stair performance, why do people fall on stairs; and what could be done to improve the performance of stairways, things of this sort that have to do both with the physiological attributes of the various persons involved, plus the actual psychological effects of some of these things.

Mr. **Walgren**. I see.

Mr. Bush, I wanted to just underscore your example of the $90 million savings or the $90 million expense that, a great part of which was apparently avoided, coming from an agency whose total budget is less than $10 million.

Mr. **Bush**. It is not hard to pay for it.

Mr. **Walgren**. You also mentioned in your testimony the role of the Center for Building Technology in the protection for reinforcing bars in bridge decks and highways exposed, and that is another area where we are literally spending billions, billions.

Mr. **Bush**. Highways and bridges are supposed to amount to a trillion, aren't they, by the time we get them all fixed up and this is a great part of the problem that it centers on.

Mr. **Walgren**. I used to know the figures in that area and they are so large that you can't keep them in your mind, and the slightest increase in our ability to prevent corrosion under those circumstances is literally worth billions and billions and billions of dollars.

I do want to say how much I appreciate the directness of your statement that this is an area that is basically not economically feasible for the private sector to pursue the directness that any social judgment would recognize that we should, and that is very helpful testimony.

Mr. **Bush**. Thank you, sir.

Mr. **Walgren**. Mr. Brown.

Mr. **Brown**. Professor Jones, is the National Institute of Building Sciences federally funded also?

Mr. **Jones**. A portion of its funds, a substantial portion of its funds were financed by the Federal Government for its first 5 years. Now, we are now in the changeover period in which financial support by the Federal Government is being phased out and we will become totally self-supportive.

Now, this is separate from any work we do for Federal agencies; contract work and so on.

Mr. **Brown**. You are compensated for work that you do for Federal agencies, passthrough money?

Mr. **Jones**. Yes.

Mr. **Brown**. I raised the question only to inquire if possibly you were facing the same budgetary problems as the Bureau of Standards is here, but apparently you were set up to transition into a private funding situation?

Mr. **Jones**. Yes, sir, the original legislation, I believe had a sum of $10 million, but it was appropriated year by year and we did not reach that level of funding. It was to phase out in the 5-year period.

Mr. **Brown**. Dr. Fenves, you mentioned a couple of areas which are of interest to me, and in the Center for Building Technology, you indicated a need for greater work to be done in the area of computer processing or computer design, and computer protocols.

You probably know there is a separate institute in the Bureau dealing with computer standards, the Institute for Computer Science and Technology.

I am just wondering if you have any views as to whether the proposals you are making with regard to the use of computer-generated data in the construction industry is a function of the Center for Building Technology or for the Institute for Computer Science and Technology, or the interface between them.

Dr. **Fenves**. I think it is the interaction between the two of them.

The technical criteria of tape density, number per inch, standard documentation for programs and so on, those are the kinds of, those are the general technical documents that are coming out from the computer science center as a result of the Brooks Act.

The specific content of what kind of pieces of information, what units, what standard abbreviations should be used in data interchange between engineers and contractors, that is not computer science stuff.

That is construction stuff, and similarly on computer programs, certainly the types of languages, standardization of the languages, that is the job of the computer center; but tests to evaluate whether a given computer program conforms to the building code is an engineering problem and not a computer science issue.

I see both of those issues requiring close cooperation between the two.

Mr. BROWN. You have referred indirectly to the role of the Center for Building Technology in the technology transfer process; that is, the generating of material of interest to the industry which is then disseminated widely to this highly dispersed and diverse industry.

In your reviews or contacts with the Bureau as a whole, have you had occasion to criticize or to comment on the effectiveness with which this technology transfer function operates as separate from the generation of the research knowledge itself?

Dr. FENVES. I definitely do remember panel members who have raised that issue.

My feeling—well, I am accustomed to living in the library, so that has never bothered me as an individual but it is my impression that the Center has over the years made a very concentrated effort to get its information out and get it disseminated.

Mr. BROWN. Basically through publication, or does it have an outreach program like, we will say an extension service or something?

Dr. FENVES. No, to the extent of the agricultural extension services and so on, but publications, industry panels, cooperation with various bodies, participation in hundreds of standards subsidies.

Mr. BROWN. Does the Center for Building Technology maintain an automated data base of any kind which can be accessed?

Dr. FENVES. I believe so.

Mr. BROWN. And which would contain the information that would be relevant to the needs of the industry?

Dr. FENVES. It is my understanding that they do in some form.

Mr. BROWN. Several years ago, I ran across a computer out in California which the Navy was maintaining that contained for defense contractors a store of materials failure information which seems to me pertinent to what the Center for Building Technology is doing; and I presume that the two data bases were interconnected but I was rather interested in this, any defense contractor who had a question about failure mode for a wide variety of information could access this computer and find out whatever information was available.

I should inquire of the Bureau whether they have anything comparable or whether they are interconnected with similar data bases in other agencies.

It might be very useful for the industry to have access to that kind of data.

Dr. FENVES. The problem in the construction industry is that there are so many partners involved in every major project, that when a failure occurs, everybody sues everybody else, and 99 percent of the technical information is locked up in court proceedings and consent decrees and is never available to the profession.

Congressman Walgren knows the 1979 failure of the I-79 bridge outside Pittsburgh. The cause of that has still not been made public. It is still tied up in an enormously complex seven-way litigation and I predict that it will never be available to technical people, or to the American Building Society, so it can review its standards.

Mr. **BROWN**. I think the public would be served if that information were available; information like the failure in the Kansas City hotel situation.

Certainly the industry should be familiar with all the technical aspects of that in order to be able to avoid repetition of that sort of thing in the future.

I have no further questions.

Mr. **WALGREN**. Mr. MacKay.

Mr. **MACKAY**. I don't have any questions.

Mr. **WALGREN**. Mr. Reid.

Mr. **REID**. No questions, Mr. Chairman.

Mr. **WALGREN**. Mr. Valentine.

Mr. **VALENTINE**. No questions, Mr. Chairman.

Mr. **MACKAY**. Mr. Chairman, I take that back.

I formerly worked as a State-level elected official and have worked with the center at the University of Florida which is very much involved in the research and construction industry areas and it occurs to me that that type center must be in being in a number of places.

How many of us in this highly fragmented industry that you serve, how many of us are reinventing the wheel? What mechanism exists to sort of identify the priority areas and make sure that we are not overlapping in our effort to deal with that? In other words, is there a Federal function and some coordination mechanism? To what extent is that function perceived or being performed?

Dr. **FENVES**. Well, there are two mechanisms I can think of. No. 1, as I tried to indicate, the codes themselves.

Many of the questions, research 'needs arise from standards and from standard enforcement processes, and those research results eventually feed into modified and improved standards.

There is a marvelous paper by my former colleague on that subject which surprises all of my colleagues who are not in construction, that the hallmark of a structural researcher's contribution to profession is not how many papers you have published but whether your provisions have been included in the building code or not.

That is how you earn brownie points.

The other mechanism, there is an interagency liaison group between National Science Foundation, Veterans' Administration, Office of Naval Research, a number of the Federal agencies dealing in the general area of structures, buildings, mechanics, and they have a program of coordination of research and research sponsorship.

Mr. **JONES**. It does not extend to universities.

There are, well, looking back you find many examples where different persons have pursued similar subjects matters, and it has not been coordinated.

The chemists used to have a system by which when a thesis was being written, they would announce this. It was recorded and if somebody else was working on it, why, that wasn't legitimate. We have nothing of this sort in the building industry that I am aware of.

Building research in a university is still highly personalized. It depends upon what the individual is interested in studying.

Mr. MacKay. As a newcomer, I am trying to make sure I understand what you said at the outset. It was very basic, and I may have missed it.

The organic legislation that set up this buildings research institute contemplated that it would go out of business at a certain point.

Mr. Jones. No, that it would become self-supporting after a period of 5 years. That was the original stipulation.

Mr. MacKay. And it has not?

Mr. Jones. It has not gone out of business.

Mr. MacKay. Or become self-supporting.

Mr. Jones. Or at the present time, see, we have been in operation only really 6 years now, and we were delayed from that establishment date in our first funding, and so there has been some overlapping of the funding.

Mr. MacKay. Is that a valid premise, that you can become self-sustaining?

Mr. Jones. It remains to be seen. I think we can, but it remains to be seen.

Mr. MacKay. I think this committee, this subcommittee, has the job of asking you by what measure do we determine whether you are succeeding or failing, in other words, the answer, or the next question from it remains to be seen is when?

Mr. Jones. When?

Mr. MacKay. What is your current time projection?

Mr. Jones. Well, we are projecting on through the next 2 years, that we will still have sufficient funds and income to survive.

Now, a lot of that will depend again on how successful we are in gaining support from the industry itself and also on the amount of things that the Government assigns us to do and supports us in doing.

Mr. MacKay. I think some of this question has been covered but specifically, now that you are 6 years into it, should your work be reordered, or your priorities be reordered, as you evaluate the work that is being done?

Mr. Jones. We have studied very carefully the situation with regard to income and our laying more stress now on the kind of support that we can get to advance our work and continue.

We are entering into a period where we are seeking endowment funds from industry to support our activities.

We are trying to expand our membership in industries in our consultative council which is the membership arm of the organization.

In other words, we are now, we have no more Federal funds to rely upon in the way of appropriation, and therefore, we are moving in this direction to get the kind of support we need, and this, of course, is what was originally envisioned, is that we would move into that area.

Mr. MacKay. Dr. Fenves, you commented that the test of whether the research is good research is when it is incorporated into standards; that would lead one to conclude that this might be an area where the marketplace really should fund it, or else it should not be funded?

Mr. Jones. Say that again?

Mr. MacKay. Well, the test of what you are doing would be whether it is something that people are willing to pay for or not, or is that too narrow a test?

Mr. Jones. Essentially that is what we are doing now; that is, our activities are being pursued on the basis that industry or I should say the building community rather than the industry, the broad building community sees enough value in them in order to continue this funding for it.

In other words, we had essentially startup funds from the Federal Government. Now we are trying to go ahead in this other way.

Mr. MacKay. Thank you.

Mr. Jones. Does that clarify it?

Mr. MacKay. I think it does.

I have a concern and I am sure others who have been here longer have the same concern, that we have an institutional attention span problem, and we have to remember 2 years from now to come back and ask the same question again.

Mr. Walgren. And it also underscores the importance of whatever the relationship between NIBS and the Bureau of Standards and the Center for Building Technology is; you perhaps do not have the standing to get basic support from private industry, because they may feel that they don't have access through you; that you really ought to be able to provide to them, and it would seem to me to be very important that no part of the Federal Government that particularly is designed to work in coordination with you withhold themselves from you, because that would be detrimental to your underlying funding source.

Mr. Jones. That is quite true. However, I don't want to leave the impression that we are poles apart on this matter because they participate in our Board meetings, and we have good interchange in that way, but we do feel that we would like to have a more formal relationship, and that we should participate more in the formation of their program early on.

I, too, was on one of the CBT's evaluation groups for I guess 6 years also, and as Dr. Fenves has mentioned, there were some programs which we felt at that time they were undertaking which were not quite appropriate.

This should be early on.

Mr. Walgren. Although time is getting beyond us, I want to pursue just one point, and that was with respect to this bridge failure in the Pittsburgh area where essentially a long, continuous weld, as I understand it, failed, and on a brand new, $30 million bridge less than a week after it was opened, a tugboat captain who happened to look up underneath the bridge and saw a gap in the span that was clearly a threatening failure.

Are there limitations to acccess by the public to technical information on that kind of a problem, and what exactly are those limitations? Who has the power to send an investigation, to evaluate that failure? Does the Department of Transportation have the power to investigate such a situation?

Dr. FENVES. It is my understanding that the Bureau can't volunteer. The Bureau has to be asked by a local agency, as in the case of Kansas City where Senator Eagleton's office was instrumental in getting the Bureau team out.

The same thing in West Virginia.

It is my understanding that that is how they have to proceed, that it has to be by an invitation of a local agency.

In the case of the I-79 bridge, the State of Pennsylvania and the Pennsylvania Department of Transportation apparently did not consider it necessary or advisable to call in an external team.

I served on the Governor's commission that provided oversight to the investigation into the repair activities, but lots of the details of the actual failure are still locked up because of the pending court actions.

Mr. WALGREN. Well, that is something I would certainly like to pursue with you independently, and perhaps you could give me some leads that I might follow, because it certainly is strange that you get major structural failures and the information not being immediately, if not sooner available to whatever professional societies are trying to digress and take account of future construction.

Mr. JONES. I would like to comment that you heard Dr. Fenves talk about all the people that were involved, and that is part of the basic problem.

The minute one of these major failures occurs there are many people that are liable for suit, and so all of them wish to pull in their horns, keep everything quiet, and——

Mr. WALGREN. Which really goes to say that we do need public investigatory scientifically, investigatory bodies that can, if the situation warrants, have access as a matter of right to whatever physical materials are involved?

Mr. JONES. Right. We need some moneys to authorize an adequate inspection that can be used by the public.

Mr. WALGREN. I want to thank the panel very much for your contributions as we will be interested in developing some of these areas with us as we go along.

Mr. WALGREN. We will now hear from Dr. Johnson, and I will ask Mr. Reid to introduce this distinguished witness.

Mr. REID. Thank you, Mr. Chairman. I would like to introduce to the panel Dr. Bruce Johnson who is from the University of Nevada in Reno, which is the mother of our university system, a school of long standing, has the famous Mackie School of the Mind. He is chairman of the Electrical Department.

You are the first witness for which I have had the responsibility of bringing to Washington, and my colleague here to my right promised after I finish this brief introduction, he would cheer and clap.

[The letter for the record from the National Institute of Building Sciences follows:]

National Institute of
BUILDING SCIENCES

1015 Fifteenth Street, N.W.
Suite 700
Washington, D.C. 20005
(202) 347-5710

April 15, 1983

The Honorable Doug Walgren
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Walgren:

Thank you for the opportunity to respond to committee questions raised during Professor Jones' testimony of March 23, 1983, at the hearing on the Center for Building Technology (CBT) and Center for Fire Research (CFR) within the National Bureau of Standards (NBS). Provided herewith are our responses to specific questions and documents requested by the subcommittee.

Question: The Subcommittee is very interested in the current relationship between NBS and NIBS, and in your suggestions for what your relationship with NBS should be. We would like to see the Memorandum of Understanding executed if this is what it would take to gain better coordination. If a draft of this document is available, could you supply us with a copy?

We appreciate the subcommittee's interest in our relationship with the Bureau. Meetings of the National Institute of Building Sciences Board of Directors are open and representatives of the Bureau have frequently taken the opportunity to attend. Moreover, CBT representatives have participated in all manner of NIBS' technical and advisory activities. These relationships are sound and productive, and that input is welcome. However, neither CBT nor CFR have regularly provided similar opportunities for input for their programs, thereby not availing themselves of the valuable resource afforded by the broad cross-section of the Institute's membership. It is in this area that the Institute seeks closer ties.

In that regard, some years ago, in recognition of the merits of a more definitive relationship, representatives of NIBS and the CBT had several discussions on the matter, which culminated in a Memorandum of Understanding (copy attached). To date, the Bureau has not executed this document although the concept was revived a few weeks ago.

In that respect, it has been our hope that a positive and constructive relationship could be developed in a framework that would facilitate regular and organized communication. The M.O.U. merely states the procedural aspects of what it is the parties agree to do and how to do it.

Question:	What has been your experience with the reluctance of the National Bureau of Standards to formalize relations with the National Institute of Building Sciences?

Perhaps the reluctance on the part of NBS is due to the perception that advice from NIBS will in some way interfere or conflict with the current network of "advisory panels" utilized by CBT and CFR in their activities or in some manner impinge on the responsibilities of the centers. The intent of the Institute is only to bring to bear authoritative recommendations on technical research priorities and to provide a conduit for the Bureau to avail itself of private sector expertise. This should complement and reinforce the interests of any other advisory panels it may feel it needs. In any event, it is our view that a definitive relationship between NBS and NIBS would be constructive and add assurance to the Congress and the public at large that the Bureau's programs in building sciences focus on needed and timely work.

Question:	Is the National Institute of Building Sciences Federally funded also?

The NIBS authorizing legislation (Section 809, Public Law 93-383) provided for $10 million to be made available over a period of five years. The authorization has now expired and NIBS has received $4.553 million of the original amount authorized through 1983. This has slowed our progress in accomplishing our basic tasks.

Question:	Are you (NIBS) compensated for the work you do for Federal agencies?

Yes. In most cases a contract, grant, or cooperative agreement is initiated to provide cost-reimbursable funds to NIBS for work requested by a Federal agency or department. There are numerous cases, however, where agency representatives and other government bodies, such as the General Accounting Office (GAO), make inquiries of NIBS concerning technical matters. NIBS complies in the belief that it has a responsibility to provide a timely and authoritative response without remuneration. Members of Congress and Congressional staff aides also utilize the services available through the Institute, which cannot, of course, be provided without cost. Indeed, a portion of the appropriated funds available to NIBS has been used for these and other activities believed to be in the national interest.

Question:	Is your relationship with Federal agencies a "pass-through"?

We are compensated for specific services carried out at an agency's request, on a time and material basis with consideration for allowable overhead items. However, NIBS is a non-profit corporation, and, as such, does not have the ability to accrue funds--except through endowments or general support grants--to provide services in the general public interest.

Historically, the Institute has subcontracted certain portions of its work in the fulfillment of technical contract requirements which is in keeping with its legislative mandate to work with existing organizations.

Question: Apparently you (NIBS) were set up to be self-sustaining..is this true?

The Congress originally envisioned that NIBS would be supported by grants, contracts, endowments, and service fees. Public Law 93-383, Section 809(g) encourages every department, agency, and establishment of the Federal government involved in building or building-related activities to provide general support grants to NIBS. Only one agency has done so to date and that was the Department of Energy. It provided a general support grant for 5 years, ending in FY 1982. Funds from the private sector are derived from membership dues, general support grants, funded projects, and endowments. A drive for private sector general support is now underway. A list of the current NIBS' membership is attached.

Question: Did the organic legislation for NIBS contemplate that it would go out of business after five years?

No. The Institute was meant to continue, at least until its mission of achieving a rational housing and building regulatory environment, and establishing a sound scientific and technical base for the industry was accomplished.

Question: Now that your organization (NIBS) is six years old, have you any recommendations to make concerning the reordering of your own priorities?

Not at this time. The Board feels that the Institute is on the right course, even though progress has been slow in some areas. We have experienced some difficulty in attaining the type of cooperation and support from Federal agencies envisioned by the Congress in our authorizing legislation. This has made the challenging task of improving the building regulatory environment and technological base more difficult than was perhaps anticipated by the Congress. As mentioned earlier, sufficient appropriations to carry out the important tasks Congress assigned to NIBS have not materialized.

In further reference to a NBS/NIBS relationship, a point we would like to make is that the nation needs a research agenda for buildings. This can best be developed by seeking input from all parties of interest and as Professor Jones pointed out, the Institute is well structured to perform that function. Research priorities could then be established with appropriate consideration of private and public interests and responsibilities.

This procedure would produce important benefits by

1. providing a vehicle to facilitate cooperation and coordination among public and private organizations in addressing the building research needs of the nation, on an ongoing basis.
2. providing opportunity to reduce redundancies in research efforts.
3. enhancing program continuity at NBS.
4. establishing a procedure to track progress and fine tune investigations.
5. providing opportunities to regularly examine cost/benefit relationships among these and other research programs.

Mr. Chairman, we refer you to our February 17, 1983, position statement on CBT and CFR (attached) in which recommendations were made for continued funding of these centers. As indicated, the NIBS Board believes their work is essential and will be enhanced through greater involvement of the broader building community. The Board further believes that the interests of the nation will be best served by bringing together, in a concerted fashion, the talents and resources of the building related activities at the NBS and the National Institute of Building Sciences.

Thank you again for this opportunity to provide you with further details concerning our March 23, 1983, statement. If you have any further questions, we will be pleased to respond.

Sincerely,

Jasper S Hawkins
Jasper S. Hawkins, FAIA
Chairman of the Board

Gene C. Brewer
Gene C. Brewer
President

ser
Attachments

CONFIDENTIAL

MEMORANDUM OF UNDERSTANDING
BETWEEN
THE NATIONAL INSTITUTE OF BUILDING SCIENCES
AND
THE NATIONAL BUREAU OF STANDARDS

The essence of the mission of the National Institute of Building Sciences (NIBS), under Public Law 93-383, is to bring about a more rational building regulatory system in the nation by simplifying and harmonizing building codes and standards, and other building regulations; and to facilitate the introduction of existing and new technology within the context of that system. The goal of this mission is to achieve greater value for consumers and users of the built environment and to foster more effective use of the nation's building resources. To ensure the authoritativeness of its findings, NIBS seeks advice from all elements of the building community primarily through its mandated Consultative Council.

The National Bureau of Standards (NBS) recognizes this unique national role of NIBS and its legislative requirement to make findings and to advise both the public and private sectors of the economy with respect to the use of building science and technology in achieving nationally acceptable standards and other technical provisions for use in Federal, state, and local housing and building regulations.

The mission of NBS as stated in the establishing Organic Act of March 3, 1901, as amended (15 U.S.C. 271), includes the functions of: "Cooperation with other governmental agencies and with private organizations in the establishment of standard practices, incorporated in codes and specifications"; "the determination of properties of building materials and structural elements, and encouragement of their standardization and most effective use..."; "the development of methods for testing materials, mechanisms, and structures..."; and "advisory service of government agencies on scientific and technical problems." Other legislative mandates for NBS are to conduct research and technical studies to improve the technical bases for criteria for building performance and to develop measurement technology for the definition of qualities affecting the usefulness, safety and economy of buildings.

NIBS recognizes this mission of NBS and its legal mandates. NIBS appreciates NBS' unique laboratory facilities and its multidisciplinary scientific capabilities.

The purpose of this Memorandum of Understanding is to establish an ongoing relationship to enable each organization to better achieve its objectives — for the benefit of the building community and the nation as a whole.

To give effect to this Memorandum of Understanding:

1. NBS agrees to become a member of and participate as such in the NIBS Consultative Council, and, within the limits of its resources, to provide a "general support grant" to NIBS as authorized under Section 809 (g) (3) of Public Law 93-383; and

CONFIDENTIAL

2. NIBS, within the limits of its resources, agrees to undertake the following:

a. Annually review the NBS proposed research program and other significant projects, and provide comment on those proposed programs and projects for their appropriateness and potential benefit to the building community and the nation.

b. Upon quarterly notification by NBS of any significant changes in or additions to its proposed program and projects, review and comment on such changes as in a., above.

c. Semiannually, review NBS program and project results, and comment upon the extent to which such results have been recognized and utilized and comment upon further appropriate steps that should be taken by NIBS and others to utilize such results.

d. Semiannually, with the assistance of its Consultative Council, prepares a report for NBS which summarizes NIBS comments over the past half year, assesses the impact of NBS activities on the building community, comments on the effectiveness of this Memorandum of Understanding, and projects long- and short-range research directions for consideration by NBS.

It is further agreed that any substantive work by NIBS or NBS for the other shall be carried-out under mutually acceptable contract arrangements as provided for in their respective legislative authorizations.

All communications and cooperative activities under this Memorandum of Understanding, shall be channeled through a single point of contact within each organization; these points of contact to be the Director of the NBS Center for Building Technology (CBT), and the President of NIBS.

Finally, it is understood that this Memorandum of Understanding may be but one of many like memoranda that may be executed between either NIBS or NBS and other public and private entities in order to carry out their respective missions most effectively in the public interest.

Director, Center for Building
Technology, NBS

President, National Institute
of Building Science

Director, National Bureau of
Standards

Chairman, NIBS Board of
Directors

Assistant Secretary for Science
and Technology, Department of
Commerce

POSITION OF THE NATIONAL INSTITUTE OF BUILDING SCIENCES (NIBS) REGARDING THE FY 1984 BUDGETS OF THE CENTER FOR BUILDING TECHNOLOGY AND CENTER FOR FIRE RESEARCH

The Department of Commerce has proposed the complete phasing out of the Center for Building Technology (CBT) and the Center for Fire Research (CFR) within the National Bureau of Standards. The National Institute of Building Sciences believes that elimination of these centers would not be wise; rather, the missions and scope of activities of CBT and CFR should be carefully evaluated with respect to the legitimate concerns of the building community.

The United States government already spends less per capita on building research than governments of other developed nations. Less is spent by the Federal government on research in building than in most other industries, despite the fact that construction represents a significant proportion of the Gross National Product and that almost 70% of the nation's wealth is represented by the value of constructed facilities. Of even greater importance is the fact that the fragmented nature of the construction industry makes it extremely difficult for the industry to conduct basic research. Indeed, such research will not be accomplished in the absence of a Federal effort. It is this research that can have meaningful impact on reducing life and property losses due to fire in a nation which leads the world in fire loss, help promote innovative technology, and help prevent deterioration of the infrastructure of our built environment.

Therefore, NIBS urges that CBT and CFR be continued with a sufficient budget to carry out their respective basic research missions. It does so with the caveat that provisions be made for greater industry involvement in the determination of CBT and CFR programs and in the review of the quality and utility of their work, and that these provisions do not involve compliance with the Advisory Committee Act.

The Congress of the United States, in passing Public Law 93-383 in 1974, found that there was need for an authoritative national source to advise both the public and private sectors of the economy with respect to the use of building science and technology. The Congress then established the National Institute of Building Sciences (NIBS) to be that source and called upon NIBS "to assign and delegate -- to the maximum extent possible -- responsibility for conducting needed activities.... to one or more of the private organizations, institutions, agencies, and Federal or other governmental entities with a capacity to exercise or contribute to the exercise of such responsibility, monitor the performance achieved through assignment and delegation, and, when deemed necessary, reassign and delegate such responsibility."

In recognition of this charge, the Congress should call upon and provide adequate funds for the National Institute of Building Sciences to evaluate the missions and current programs of CBT and CFR with respect to the research needs of the building community and to make recommendations to the Secretary of Commerce and the Congress as to an appropriate research agenda for these centers.

APPROVED FEBRUARY 17, 1983

BOARD OF DIRECTORS

ORGANIZATIONAL MEMBERS

ACADEMIC & RESEARCH

Apartment House Institute
University of Arizona
California Polytechnic State University
Clemson University/Dept. Civil Engineering
Construction Market Information
Drexel University/Center for Insulation Tech
University of Florida/Arch. & Building Research
University of Illinois/Department of Architecture
Iowa State University/Building Energy Utilization
Louisiana Institute of Building Sciences
MIT/Department of Architecture
University of Michigan/NPCH&LAOA
New Jersey Energy Research Institute
Oak Ridge National Laboratory
University of Tennessee
Texas A&M University
Texas A&M University/Dept of Building Construction

ARCHITECTURAL, ENGINEERING & DESIGN

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Associated Architects
The Austing Company
Barge/Waggoner/Sumner & Cannon
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Boarman Architects, Inc.
Burton & Vanhouten Engineers
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Cannon Design, Inc.
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Collins & Kronstadt
David Jacobson Associates

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Enviro-Management & Research Inc
Envi & Energy Engineering Co
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Fohrman/Lurie/Sklar & Simon
M. Arthur Gensler, Jr. & Associates
Melvyn Green & Associates, Inc.
Hanna Engineering Corporation
Hatch Associates Consultants
Hueber Hares Glavin
Jaros/Baum & Bolles Consulting Engineers
Jewell Building Systems, Inc
Keeva J. Kekst Assoc. Arch., Inc.
Macina/Bose/Copeland & Associates
Walter P. Moore & Associates, Inc.
Roof Engineering Inc
Ross & Baruzzini, Inc.
Scaffidi & Moore Architects
Sears Roebuck and Company
Skidmore Owings & Merrill
Sodemann & Associates, Inc.
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Swenson-Smith-Crane, A/E
Thorsell/Kennedy/Casker Et Al
Tufts & Wenzell Architects, Inc.
Ulrich Frazen/Keith Kroeger
Welton Becket Associates
Steven Winter Associates, Inc.
Ziegler/Kirven/Parrish Architects
F D Koppel Associates

FEDERAL, STATE & LOCAL GOVERNMENT

Town of Amherst/Building Dept

Chesterfield County

City of Cincinnati/Bldg & Insp

City of Clearwater/Bldg Dept

City of Dallas/Bldg Insp Dept

City & County Denver/Bldg Insp

Dormitory Authority/St of NY

City of Fairfax/Dept Envir Mgmt

St Florida/Dept Vet Comm Affrs

Forest Prdts Lab/FS/USDA

Indiana Admin Bldg Council

Lake County Bldg Dept

Maryland State Dept Education

City of Mentor

Mesa City/Cty Bldg Insp Dept

City of Middletown/Div Insp

Township of Monroe/Constr Code

Montgomery Cty/MD Govt

Dept Navy/Naval Fac Eng Comman

Nebraska Energy Office

New Jersey St/Dept Comm Affrs

NYS Div of Hsg & Comm Renewal

Norfolk Redev & Hsg Authority

City of North York/Bldg Dept

NYC Office Energy Conservation

Office of Uniform Building Cod
Township of Pennsauken

City of Portland/Bur of Bldgs

Reedy Creek Improvement Distri

Richland Cty Building Dept

Rockdale Cty GA/Engr Dept

City of Rockville/Div of L&I

Cty Sacramento/Bldg Insp DI

City of Shrewsbury Missouri

Spokane Cty Building Codes

ST NY Office General Svcs

State Univ Construction Fund

Texas Dept Community Affairs

HQ USAF Directorate Engrg & Sv

United States Army/CERL

Veterans Admin/Ofc of Constr

Western Washington University

City of Wichita

City of Worcester/Dept Code In

CONSULTING

Building Technology Inc
Connerly & Associates Inc
Construction Consultants Inc
Construction Management Associates
Construction Administrative Services
The Construction Consulting Service
Econ Incorporated
Energy Auditors & Consultants
Fails Management Institute
W S Fleming & Associates Inc
General Systems Inc
James W Griffith Inc
Heery Program Management Inc
Home Improvement Time
The Code Consortium
Home Raters Inc
Interactive Graphics Services Corp
International Energy Associates Limited
Arthur D Little Inc
MacDonald/Halsted & Laybourne
Carl Meglan and Company
David S Miller & Associates
Potomac Energy Group
The Proudfoot Co Inc
Qualify Building Inspection Corp
Jack M Roehm & Associates
Speser Associates
Stephen W Cunningham & Associates
Stevens-Mansueto Inc
Structural Mechanics Associates
H R Trechsel Associates
Wescott Associates
W Wohlstein & Associates
energy Inc

BUILDING CONSTRUCTION (including contractors & subcontractors)

Cary-Way Building Company
Cedarwood Construction Co.
Duffel Financial & Construction Co
Hanscomb Associates Inc
Huth-Westwood Builders Inc
Institute of the Ironworking Industry
Johnson Controls Inc
Lasker-Goldman Corporation
McCombs Electric Co Inc
Metalex
Polex Inc
David C Smith Inc
Southwest Domes & Homes
Tishman Research Corp
Turnberry Corp
U S Geodesics
Verdome Inc
The Volpe Construction Co Inc
Tallman Pools of Longview

CONSUMER GROUP & ENVIRONMENTAL

Community Associations Institute
University of Georgia/Dept of HMC
National Consumers League
Polish National Alliance Lodge 3218

HOUSING

Cathedralite
Cenvill Development Corp
Construction 2000 Inc
Domes Homes Construction
Drexel Properties Inc
Electrical Associates Inc
Fleetwood Enterprises Inc
The Ghard Co

HOUSING (CONTINUED)

E P Giuliano Construction Inc
Knott Builders Services
Larrymore Foundation
Modulars Inc
Monterey Domes Inc
National Corporation for Housing Partnerships
Natural Habitat Domes of Alaska
Park Towne Development Corp
Pasadena Homes Inc
The Perl-Mack Companies
Ryan Homes Inc
Bob Schmitt Homes Inc
Southern Igloos
Texas Domes & Homes
Unibuilt Industries Inc
Guerdon Industries Inc

MEDIA

Building Design & Construction Magazine
Muir Publishing Company Ltd
Professional Builder Magazine
Specifying Engineer Magazine

MATERIAL & PRODUCT MANUFACTURERS

Accessible Products Company
ARCO Chemical Company
Armstrong World Industries
Bethlehem Steel Corporation
Butler Manufacturing Company
The Celotex Corporation
Certain-Teed Corporation
Crown Corporation
Dow Chemical USA
Dome Creations
EWS Ltd., Inc.
The Flintkote Company
General Electric Company
Geodesic Domes & Homes
W R Grace & Co./Construction Prdts Div.
Honeywell Inc/Commercial Div.
Howmet Aluminum Corp
Inryco, Inc.
International Paper Company
Leigh Products Division
Lightolier Inc
LOF Glass
Manville Corporation
Masonite Corporation
Owens-Corning Fiberglas Corp
PPG Industries Inc
Rockwood Industries Inc
Rohm and Haas Company
Schlegel Corporation
Simplex Products Div.
Simpson Timber Company
Tremco Inc
US Fiber Corporation
United States Gypsum Company
United Technologies Corp
Westex Corporation
Weyerhaeuser Company

MORTGAGE/FINANCE

U.S. League of Savings Associations

OWNER/USER

Cavanaugh Lakeview Farms Ltd.
Century Development Corp
Filley & Company Inc
Hospital Corporation of America
IBM Corporation
Sisters of St. Mary

REALTY & INSURANCE

Bramberg Management Organization, Inc.
Home Owners Warranty Corp
The Travelers Insurance Co.

TESTING LABORATORY & CERTIFICATION

American Council of Independent Laboratories
Canadian Standards Association
MET Electrical Testing Co. Inc.
Mineral Insulation Manufacturers Association
RADCO, Inc.
THETA, The Technical Associates Inc
Underwriters Laboratories, Inc.

TRADE ASSOCIATION

Aluminum Association Inc
American Assoc of Housing Educators
American Consulting Engrs Council
American Fire Sprinkler Assoc Inc
American Gas Association
American Hardboard Association
American Home Lighting Institute
American Institute of Steel Constr
American Iron & Steel Institute
Applied Technology Council
Architectural Aluminum Mfgrs Assn
Asphalt Roofing Mfgrs Assn
Assn of the Wall & Ceiling Industry
Association Services Corp
Associated Builders & Contractors
Associated General Contrs of Amer
Associated Builders & Owners of Greater New York
Assn of Collegiate Schools of Architecture
Building Industry Assn of So. Calif
Bldg Manufacturers Assn of Chicago
Bldg Owners & Managers Assn
Bldrs Hardware Mfrs Assn
Brick Institute of America
Bldg Owners & Mgrs Assoc of Cleveland
Calif Bldg Industry Assn
Canadian Wood Council
Concrete Masonry Assn of Calif & Nevada
Contractors Assn of West Virginia
Copper Development Assn Inc.
Edison Electric Institute
Florida Homebuilders Assn
Gypsum Association
Indiana Mfrd Hsg Assn Inc
Industrialized Stapling & Nailing Technical Association

TRADE ASSOCIATIONS (CONTINUED)

Industrialized Housing Mfgrs Assn
Institute of Real Estate Management
Insulation Contractors Assn of America
International Assoc of Bridge Structural & Ornamental Iron Workers
Manufactured Housing Institute
Metal Building Mfgrs Association
National Electrical Contractors Association
National Apartment Association
National Association of Home Builders
National Association of the Remodeling Industry
National Building Granite Quarries Association
National Building Material Distr. Assn
National Concrete Masonry Assn
National Construction Products Mfgrs Council
National Dome Association
National Electrical Mfgrs Assn
National Forest Products Assn
National Insulation Contractors Assn
National LP-Gas Association
National Lumber Building Material Dealers Association
NYC Builders Association
Ohio Home Builders Association
Ohio Ready Mixed Concrete Association
Plumbing Manufacturers Institute
Portland Cement Association
W F Pruter Associates
S M A-C N A
Society of the Plastics Industry
Structural Engineers Association of California
Texas Manufactured Housing Association
Thermal Insulation Mfgrs Association
Truss Plate Institute
Western Fire Chiefs Association

TRADE UNION

AFL-CIO/Bldg & Construction Trades
Bricklayers International Union
International Brotherhood Electrical Workers
Michigan State Building and Construction Trade
OP&CM International Association
Sheet Metal Workers International Association
United Brotherhood of C&J of America

PROFESSIONAL SOCIETY

The American Institute of Architects
ASHRAE, Inc.
American Society of Home Inspectors
Architects Society of Ohio/AIA
APPA of Universities & Colleges
Electrical Council of Florida
National Academy of Code Admin
National Society of Prossional Engineers
Ohio Building Officials Association
Ohio Professional Engineers Constr
Society of American Registered Architects
West VA Society of Architects

UTILITY (GAS, ELECTRIC, TELEPHONE)

American Telephone & Telegraph

Georgia Power Company

New York Telephone

PSEG Research Corporation

Philadelphia Electric Company

Southern Union Gas Company

CODES & STANDARDS

American Society of Sanitary Engrg

ASTM

Building Officials & Code Admin

Bureau of Building Inspection

Council of American Building Officials

International Association of Plumbing & Mech Officials

International Conference Building Officials

NCS/BCS

Southern Building Code Congress International

National Institute of
BUILDING SCIENCES

1015 Fifteenth Street, N.W.
Suite 700
Washington, D.C. 20005
(202) 347-5710

Consultative Council

MEMBERSHIP
GROUP REPRESENTATION

MONTH OF: As of March 31, 1983

MEMBERSHIP GROUPS	ORGANIZATIONS	ADDT'L REPS	INDIVIDUALS	TOTAL	%
Academic & Research	17	3	23	43	6
Architectural, Engrg, & Design	49	15	70	134	18
Bldg Material & Prdt Distri	–	–	2	2	.5
Federal, State & Local Govt	44	12	31	87	11
Consulting	34	7	23	64	8
Bldg Constr (Contractors & Subs)	19	7	13	39	5
Consumer & Environmental	4	–	6	10	1
Housing	24	8	17	49	6
Media	4	2	1	7	1
Material & Prdt Manufacturer	37	42	15	94	12
Mortgage/Finance	1	1	–	2	.5
Owner/User	6	–	2	8	1
Realty & Insurance	3	1	2	6	1
Testing Lab & Certification	7	6	2	15	2
Trade Association	67	51	3	121	16
Trade Union	7	5	–	12	2
Professional Society	12	6	1	19	2
Utility (gas, elec., phone)	6	5	3	14	2
Codes & Standards	9	16	11	36	5
TOTALS	350	187	225	762	100%

STATEMENT OF DR. BRUCE P. JOHNSON, CHAIRMAN, DEPARTMENT OF ELECTRICAL ENGINEERING, UNIVERSITY OF NEVADA AT RENO, RENO, NEV.

Dr. JOHNSON. Thank you, Mr. Reid, and Mr. Chairman.

It is a distinct honor for me to be able to talk to you today concerning robotics, automated manufacturing, and the efforts of the National Bureau of Standards in this field. I confess that I am not an expert in the field of robotics and my area of research interest does not include robotics.

However, I have spent 8 years in industrial research with the General Electric Company, 9 years in the academic environment doing teaching and research in both physics and electrical engineering, and 4 years on a part time basis as a presidential appointment to the United States Metric Board.

I currently serve as a consultant to the General Telephone and Electronics Research Laboratory on future technology forecasting. Hence, I hope that you will consider my testimony to be that of a neutral party to your deliberations with the best interests of the United States of America in mind.

Research has been going on in the area of robotics for many years. However, progress has been relatively slow and to a considerable extent tied to the technological advancement and price decline of computers. For example, it is only recently that several universities have made a major commitment to robotics research and education. However, the 1980's and 1990's can be a period of rapid development in robotics with a major impact on productivity and international trade in the United States There are several reasons for this. Let me cite a few.

(1) The low cost of computer power as reflected in the growth of the personal computer industry.

(2) The recent progress in speech synthesis and speech recognition.

(3) The development of low-cost sensors to see, feel, and sense the position of objects in a number of ways. However, I should point out that there is still considerable research to be performed in this area.

(4) The development of hierarchical and parallel processing concept for rapid data analysis. There are several other developments I would cite but let me get to the point.

Last December 7, the Institute of Electrical and Electronics Engineers ran a 5-hour conference on the status of robotics in the United States and in the world. This was transmitted live via satellite to over 90 sites in the United States. Our university was one of the sites. The institute chose four of the most knowledgeable researchers in the United States to present the conference. Dr. James Albus of the National Bureau of Standards was one of the four chosen and discussed the work going on at the Bureau while defining major problem areas to be addressed.

The message I want to convey is that the current work going on at the Bureau is among the most advanced in the country. I am somewhat familiar with Federal Government research in some other areas, and can state that this is not necessarily always true. Reducing or eliminating funding for this program would handicap one of the areas in which the Government is doing an outstanding job. NBS is pursuing research related to interface standards, performance measures, and programing language standards.

While some people might argue that standards are an inhibiting influence on a newly developing field, I would argue the opposite. Well chosen interface standards, structured to accommodate enhancement, promote market competition, technology development, and technology transfer. We severely goofed in the computer industry by not developing standards early in the game. The same is also true of metric standards.

In robotics, we are not even the leader—Japan is—and so we are going to have to move faster. We desperately need a Government agency to coordinate activity between Government, industry and the universities—to recommend and assist with standards development and technology transfer.

Industry efforts will continue to be fragmented. Military robotics efforts will continue to be classified. We must have NBS playing the vital coordinating role that they are currently so successfully doing if we ever hope to see the totally automated factories of the year 2000 in the United States. Without this coordinating effort, we are likely to find ourselves importing this technology from some of our major trading partners.

The required effort at NBS goes beyond focusing on standards only. The type of research they are pursuing requires a long term investment and hence is not traditionally addressed by the private sector, even though the potential payback is much greater than the investment. University research is typically either very basic research supported by the Government or very directed and applied research funded by private industry.

While the NBS research covers similar areas such as vision, control and data structures, its focus is unique—that of measurement technology, standards for performance comparisons, and interface standards. It is research not addressed by the private sector or by universities. Since robotics is in its infancy, we must keep robotics research moving on all fronts.

In summary, the robotics/automated manufacturing effort is as critical to our long term national interest as our space program is and continues to be. I urge you to support the NBS funding request for the 1984 budget.

Thank you.

[The prepared statement of Dr. Johnson follows:]

STATEMENT OF DR. BRUCE JOHNSON

Mr. Chairman, Members of Congress: It is a distinct honor for me to be able to talk to you today concerning robotics automated manufacturing, and the efforts of the National Bureau of Standards in this field. I confess that I am not an expert in the field of robotics and my area of research interest does not include robotics. However, I have spent 8 years in industrial research with the General Electric Co., 9 years in the academic environment doing teaching and research in both physics and electrical engineering, and 4 years on a part-time basis as a Presidential appointment to the U.S. Metric Board. I currently serve as a consultant to the General Telephone and Electronics Research Laboratory on future technology forecasting. Hence, I hope that you will consider my testimony to be that of a neutral party to your deliberations with the best interests of the United States of America in mind.

Research has been going on in the area of robotics for many years. However, progress has been relatively slow and to a considerable extent tied to the technological advancement and price decline of computers. For example, it is only recently that several universities have made a major commitment to robotics research and education. However, the 1980's and 1990's can be a period of rapid development in robotics with a major impact on productivity and international trade in the United States. There are several reasons for this. Let me cite a few.

1. The low cost of computer power as reflected in the growth of the personal computer industry.
2. The recent progress in speech synthesis and speech recognition.
3. The development of low-cost sensors to see, feel, and sense the position of objects in a number of ways. However, I should point out that there is still considerable research to be performed in this area.
4. The development of hierarchial and parallel processing concepts for rapid data analysis. There are several other developments I could cite, but let me get to the point.

Last December 7, the Institute of Electrical and Electronics Engineers ran a 5-hour conference on the status of robotics in the United States and in the world. This was transmitted live via satellite to over 90 sites in the United States. Our university was one of the sites. The Institute chose four of the most knowledgeable researchers in the United States to present the conference. Dr. James Albus, of the National Bureau of Standards, was one of the four chosen and discussed the work going on at the Bureau while defining major problem areas to be addressed. The message I want to convey is that the current work going on at the Bureau is among the most advanced in the country. I am somewhat familiar with Federal Government research in some other areas and can state that this is not necessarily always true. Reducing or eliminating funding for this program would handicap one of the areas in which the government is doing an outstanding job.

NBS is pursuing research related to interface standards, performance measures, and programming language standards. While some people might argue that standards are an inhibiting influence on a newly developing field I would argue the opposite. Well chosen interface standards structured to accommodate enhancement, promote market competition, technology development, and technology transfer. We severely goofed in the computer industry by not developing standards early in the game. In robotics, we are not even the leader—Japan is—and so we are going to have to move faster. We desperately need a government agency to coordinate activity between Government, industry, and the universities—to recommend and assist with standards development and technology transfer. Industry efforts will continue to be proprietary. University efforts will continue to be fragmented. Military robotics efforts will continue to be classified. We must have NBS playing the vital coordinating role that they are currently so successfully doing if we ever hope to see the totally automated factories of the year 2000 in the United States. Without this coordinating effort, we are likely to find ourselves importing this technology from some of our major trading partners.

The required effort at NBS goes beyond focusing on standards only. The type of research they are pursuing requires a long-term investment and hence is not traditionally addressed by the private sector. Even though the potential payback is much greater than the investment. University research is typically either very basic research supported by the Government or very directed and applied research funded by private industry. While the NBS research covers similar areas such as vision, control, and data structures, its focus is unique—that of measurement technology, standard for performance comparisons, and interface standards. It is research not addressed by the private sector or by universities. Since robotics is in its infancy, we must keep robotics research moving on all fronts.

In summary, the robotics/automated manufacturing effort is as critical to our long-term national interest as our space program is and continues to be. I urge you to support the NBS funding request for the 1984 budget. Thank you.

Mr. WALGREN. Thank you very much, Dr. Johnson.

I would like to say how valuable the comments are from somebody who might not be totally enmeshed in a program, but have the personal interest and the background to be able to make some relatively sound judgments and appreciation of value.

One of the difficulties it is for many of us, without a background in an area, we cannot really appreciate the value and the potential.

Our majority leader on the Democratic side referred to OMB the other day as a people who know the cost of everything and the value of nothing, and I confess that it is hard for me to really appreciate the value and the potential for many of these programs because I don't have the background for it to make sense to me, so your testimony is very valuable and I wish to express my personal appreciation and that of the panel for it.

Mr. McKay.

Mr. MacKay. I see some numbers, Dr. Johnson, that are just handwritten on your written statement.

I interpret them to mean that we are functioning at a level now in this area that is perhaps in the magnitude of one-tenth of what Japan is doing.

Dr. Johnson. That is correct, it is really difficult to get the figures for Japan, so there are estimates between 3 times and 10 times our current spending rate. France will be investing $400 million over the next 3 years, which was recently announced.

Looking at our current expenditures, my best estimates were about $10 million internally within the Federal Government and an additional $5 million to universities through NSF grants so we are spending considerably below some of our competitors in the world market.

Mr. MacKay. I would see this, if we were trying to make any rationalization of the Federal role in research and one of the areas where probably there would be good logical reasons for an expanded role.

It is applied research in a sense, but in a sense, because it is all new, it is basic research.

Dr. Johnson. I would certainly encourage taking a look at expenditures, although one can always overdo it. That has been done in the past in some other areas.

Mr. MacKay. You essentially are saying that because of the different places the research is going on, the Bureau of Standards has a role that nobody else can perform, and that is very helpful.

That aspect of it I had not thought about.

Thank you, Mr. Chairman.

Mr. Walgren. Mr. Reid.

Mr. Reid. I wish Mr. Brown were here, because this is something, while I have sat with him on this committee, he is very precise in talking to witnesses about the overall picture, how does this robotics program fit into the overall picture, and I would repeat what Congressman McKay said, if there is an area that we have been confronted with on this committee that needs some looking into it, it would be this area; and the reason being, we need someone to gather the information, somebody that looks to see what is happening at the university programs, find out what is going on on the industry level, and somebody that is not in it to make a dollar, so to speak, so we can see.

Many governments are doing the research that our university systems are doing and that private industry is doing. Governments are involved in that directly, and the least that we could do is be a resource for the university systems and certainly for industry.

Mr. Walgren. We have such a limited view of government, and I understand that there are reasons for that and a certain value from them. However, I think it is also fair to say that many of the limitations we put on government in our society are really arbitrary, the result of arm wrestling between specific interests, and it is not limitations that win out under those circumstances, or at least arbitrary limitations, and when you look at our system and realize that we really have no international trade policy as a Nation, none, here is an area where we are going to just be left at the starting gate with extremely damaging, economically damaging consequences logically projected, in the face of other governments carrying out programs on multiples of our society as a whole, even though our society is so much larger in every way, and yet we don't seem to be able to do very much with it.

I went to a major engineering laboratory in Pennsylvania, a major university, leading in its field, and in going into the laboratory, there was literally a large room full of World War II Government surplus machinery that had been given the school by the Defense Department, and two robots that had been charitably contributed by Japanese companies, and that was the extent of the facilities in that university.

It just is incredible to think that how we have had to do almost everything we have done under the umbrella of defense, as if that had some logic, and it has none in my view; and have been so unable to bring a considered judgment of the role of government as opposed to arbitrary limitations on the role of government in my view, so I just, I would, I just do want to underscore how helpful it is to the committee to have somebody who has a reasonable citizen view of these areas, coupled with the expertise to have some judgment and appreciation of value, because we often don't get that.

I will recognize Mr. Brown for any thoughts on the robotics side of this.

Mr. REID. We already made him a hero in his absence.

Mr. BROWN. Thank you, I will be absent more often.

Mr. WALGREN. Robert Frost wrote a poem about a person that was in the center of a circle and knew, he just was there and he knew.

Mr. Brown sometimes performs that role for us.

Well, thank you very much, Dr. Johnson.

We appreciate your contribution very much.

Dr. JOHNSON. Thank you, Mr. Chairman.

Mr. WALGREN. Continuing to try to work with some of our time constraints of the witnesses, I wish to go back now to finish the area on building and fire research and if I could call Mr. Ralph Rowland, who is the Chairman of the Codes and Standards Committee of the American Institute of Architects.

Please present your testimony to the committee, Mr. Rowland.

STATEMENT OF RALPH T. ROWLAND, FAIA, THE AMERICAN INSTITUTE OF ARCHITECTS, ACCOMPANIED BY PHILIP R. CROESSMANN, STAFF, AMERICAN INSTITUTE OF ARCHITECTS

Mr. ROWLAND. I have with me Mr. Phil Croessmann of the American Institute of Architects staff who would be able to help me in responding to any questions.

I am here today representing the American Institute of Architects, which is the professional association for the architects of the United States, and my personal background is, to give some relationship to the field that we are concerned about this morning, I am director of architectural research of the Connecticut firm of Fletcher-Thompson, Inc., an architect engineering firm, and my responsibilties include code, standards and environmental concerns; and as has been pointed out, I am Chairman of the American Institute's Architect's Codes and Standards Committee.

The American Institute of Architects opposed the proposed elimination of funding for the Center for Building Technology and the Center for Fire Research. In our opinion, the design community and the public have benefitted from the research programs carried out at the National Bureau of Standards, NBS. They have made important contributions in the areas of seismic safety, energy conservation and fire research.

The AIA cannot accept the administration's assertion that the private sector or local and State governments can provide the nonproprietary technical research needed in these areas. The nonproprietary aspect of it is very important to us, because it is the objectivity that makes it so valid for our purposes.

No one element in the building sector would find it to its economic advantage to carry out the activities that NBS has been responsible for. Additionally, NBS is in a position to provide impartial information, a function that would be lost if NBS's programs were to be eliminated.

The stucture of the building industry prevents it from picking up the type of research that NBS carries out. The building industry, which in 1981 accounted for $234 billion or 8 percent of the gross national product, is a highly fragmented industry. Of the 1.2 million firms which employ 4.3 million workers, approximately 60 percent are small businesses.

For example, 80 percent of the architecture firms in this Nation have fewer than 10 employees. Engineering firms are only slightly larger. Because of this fragmentation, the research capacity of the design community is very limited. Some of the other points have been covered, so I won't try to duplicate that.

In August 1982, the AIA testified before the oversight subcommittee of this committee on structural failures in public facilities, where we outlined the need for more data for the systematic analysis of the Nation's building failures. At that time, the Institute applauded the Center for Building Technology's independent investigation of structural failures, such as the Kansas City Hyatt collapse. The NBS investigation provided insights into the causes of that collapse that would have otherwise gone undocumented.

That is an important point. We have documentation there on what happened, which is very important for the development of codes and standards in the future to hopefully prevent such things from coming about again.

These investigations provide valuable information which will help prevent past mistakes from being repeated. However, we must stress that investigations on building failures are costly. For example, NBS's investigation of the Hyatt Hotel collapse cost about a half a million dollars. In most cases, the cost of these investigations on complex structures ranges between $100,000 and $500,000. Each year NBS carries out one or two indepth investigations as well as several minor ones. We think this investigatory capacity should be expanded.

Those are far beyond the type of costs that we have in the building industry to underwrite. We would like to emphasize that the American Institute of Architects has also supported programs which seek to protect the health, safety, and welfare of the public.

The Institute convened a long-standing building panel in recent years, and a life safety task force to study issues of safety in public buildings but these limited scope studies cannot replace by any means the nonproprietary technical research being performed by the National Bureau of Standards.

The AIA can disseminate information generated by Federal efforts to the architectural profession as we have done in the energy area, but we cannot undertake the basic research in these areas. So we believe that continued funding for the Center for Building Technology and the Center for Fire Research is essential to the continuation of these important areas of investigation.

We believe that these programs should be funded at least in the amounts appropriated for fiscal year 1983.

The National Bureau of Standards plays a unique role in supporting much-needed research for a highly fragmented industry.

We believe that the small investment in research today will result in major savings in the prevention of future loss of life and property.

Thank you very kindly for allowing me to come here today and I would be very happy to respond to any questions that you may have.

[The prepared statement of Mr. Rowland follows:]

THE
AMERICAN
INSTITUTE
OF
ARCHITECTS

1735 New York Avenue, N.W.
Washington, D.C. 20006
Telephone: (202) 626-7300
Cable Address: AMINARCH
Telex: 710822 1112

THE FY 1984 BUDGET FOR THE NATIONAL BUREAU OF STANDARDS' CENTER FOR BUILDING TECHNOLOGY and CENTER FOR FIRE RESEARCH

A Statement by

RALPH T. ROWLAND, FAIA
on behalf of
THE AMERICAN INSTITUTE OF ARCHITECTS

COMMITTEE ON SCIENCE AND TECHNOLOGY
SCIENCE, RESEARCH AND TECHNOLOGY SUBCOMMITTEE
U.S. HOUSE OF REPRESENTATIVES

March 23, 1983

Mr. Chairman, my name is Ralph T. Rowland, FAIA. I appear today on behalf of The American Institute of Architects, the professional association representing this nation's architects. I am Director of architectural research, for the Connecticut firm of Fletcher-Thompson, Inc., an architect-engineer firm, where my responsibilities include codes, standards and environmental concerns. I am also chairman of the Institute's Codes & Standards Committee.

The American Institute of Architects opposes the proposed elimination of funding for the Center for Building Technology and the Center for Fire Research. In our opinion, the design community and the public have benefited from the research programs carried out at the National Bureau of Standards (NBS). They have made important contributions in the areas of seismic safety, energy conservation and fire safety research.

The AIA cannot accept the administration's assertion that the private sector or local and state governments can provide the non-proprietary technical research needed in these areas. No one element in the building sector would find it to its economic advantage to carry out the activities that NBS has been responsible for. Additionally, NBS is in a position to provide impartial information, a function that would be lost if NBS's programs were to be eliminated.

The structure of the building industry prevents it from picking up the type of research that NBS carries out. The building industry, which in 1981 accounted for $234 billion or 8 percent of the gross national product, is a highly fragmented industry. Of the 1.2 million firms which employ 4.3 million workers, approximately 60 percent are small businesses. For example, 80 percent of the architecture firms in this nation have fewer than 10 employees. Engineering firms are only slightly larger. Because of this fragmentation, the research capacity of the design community is very limited. The research carried out by architectural and engineering firms is of an applied nature and is limited to the information needed for specific design and construction projects. And the research components of the building industry's trade and professional associations are unable to pick up the type of research that has been carried out by NBS.

In an industry such as ours, which is mainly made up of small businesses, we cannot assume that market forces, such as litigation costs from building failures, will spur private sector research. For example, architectural and engineering firms are already suffering from severe liability problems, due to incremental changes in tort law. In 1981, the claim rate for A/E firms was 45 per 100 insured firms. The average cost of these claims was $64,000. Yet, because of the fragmented nature of these experiences, this substantial increase in the cost of doing business has not brought about an increase in the amount of private sector research on structural failures. While groups like the University of Maryland's Architecture and Engineering Performance Information Center can analyze and disseminate information on structural failures, they cannot directly perform the research. Nor can any single architectural firm or consortium of architectural and engineering firms perform this type of research.

In August of 1982, the AIA testified before the oversight subcommittee of this Committee on structural failures in public facilities, where we outlined the need for more data for the systematic analysis of the nation's building failures. At that time, the Institute applauded the Center for Building Technology's independent investigation of structural failures, such as the Kansas City Hyatt collapse. The NBS investigation provided insights into the causes of that collapse that would have otherwise gone undocumented. These investigations provide valuable information which will help prevent past mistakes from being repeated. However, we must stress that investigations on building failures are costly. For example, NBS's investigation of the Hyatt Hotel collapse cost about a half a million dollars. In most cases, the cost of these investigations on complex structures ranges between $100,000 and $500,000. Each year NBS carries out one or two in-depth investigations as well as several minor ones. We think this investigatory capacity should be expanded.

Recent structural failures and fire disasters have brought forth a public outcry for safer buildings. Research to further this goal should be carried forward with enthusiasm worthy of the public trust. Research on these subjects protects the health and welfare of the nation's citizens, a well-established federal responsibility.

By eliminating funding for these programs, the Administration seems to be saying that this long-held federal responsibility should be left to private sector organizations.

In conclusion, The American Institute of Architects has always supported programs which seek to protect the health, safety and welfare of the public. In recent years, for example, the Institute convened a Long-Span Building Panel and a Life Safety Task Force to study issues of safety in public buildings, but these limited-scope studies cannot replace the non-proprietary technical research being performed by NBS. The AIA can disseminate information generated by federal efforts to the architectural profession, as we have done in the energy area, but we cannot undertake the basic research in these areas.

Continued funding for the Center for Building Technology and the Center for Fire Research is essential to the continuation of these important areas of investigation. We believe that these programs should be funded at least in the amounts appropriated for FY 1983. NBS plays a unique role in supporting much-needed research for a highly fragmented industry. We believe the small investment in research today will result in major savings in the prevention of future loss of life and property.

Mr. **Brown** [presiding]. Thank you, Mr. Rowland. We do appreciate your testimony and it is particularly important in showing the awareness of the AIA of this problem and their concern for it.

I was trying to sort out in my own mind one area, and that is the degree to which the kind of information which you have been discussing, the failure problems in a major structure, whether that information is being adequately disseminated through the Center for Building Technology to the entire industry of whether there are improvements that could be made in that dissemination process, and I do not have any specific criticism in mind.

I have been impressed with the communication problem involved in communicating to such a large and diversified industry, and I am wondering if we have the mechanism to accomplish that effectively at the present time.

Mr. **Rowland**. I would respond to that with a personal view of the way this generally comes to be used.

The National Technical Information Service, of course, provides the identification to those who subscribe to it of the types of research reports that are available and certainly this type of report immediately catches the eye of the reader; and one who is interested in that type of information will immediately respond by obtaining it.

The way this is used, and I think it was Dr. Fenves who used the term, that codes are a collective memory. I wrote that down, because that struck me as a very significant way of putting it.

The research that comes from the kind of study that is conducted by the NBS and particularly, let's say, the Center for Fire Research and the Center for Building Technology, is used in the proposal to change building and life safety codes.

This is the way it usually comes about, and this then becomes eventually a provision or provisions, collective provisions of the codes which are then used by the practicing architect and engineering in the design and oversight and construction of these buildings.

That is the way this really comes about.

There is no question that in the case of the model code agencies, they are concerned about constant improvement of the codes, and many, many people who participate in that process, the information that is available from these research programs is pumped into that and eventually after a lot of assisting and consideration becomes part of the provisions of the codes that are used for the design of buildings by the architects and engineers.

That is the process. I don't know whether I am answering your question properly or not, but I think it certainly never is in any way overlooked. It gets to the point where it will eventually be used.

Mr. **Brown**. Thank you very much, Mr. Rowland, for your testimony.

I know there are some other questions that we would like to ask but because of the pressure of time, we will excuse you at this point.

Mr. **Rowland**. Thank you very much.

Mr. **Brown**. Next I will call Mr. Hartwell Keith, president of the National Conference of Standards Laboratories.

Mr. Keith is accompanied by Dean Brungart and George Rice.

The National Conference of Standards Laboratories is well represented this morning.

Mr. Keith, your statement will be inserted in the record in full.

STATEMENTS OF HARTWELL KEITH, PRESIDENT, NATIONAL CONFERENCE OF STANDARDS LABORATORIES, AND MANAGER OF METROLOGY, TRW, INC., ACCOMPANIED BY DEAN A. BRUNGART, IMMEDIATE PAST PRESIDENT, NATIONAL CONFERENCE OF STANDARDS LABORATORIES, DIRECTOR OF METROLOGY, TELEDYNE SYSTEMS CO.; AND GEORGE RICE, EXECUTIVE VICE PRESIDENT, NATIONAL CONFERENCE OF STANDARDS LABORATORIES, MANAGER OF METROLOGY, ROCKWELL INTERNATIONAL

Mr. **Keith**. In the interest of brevity then, I will deviate slightly from the written text and proceed to the more pertinent points.

By way of background, the National Conference of Standards Laboratories, NCSL, is a nonprofit organization with a membership in excess of 500 organizations, and agencies.

We have a strong interest and direct participation in the field of metrology and the operation of calibration laboratories.

The majority of our members are users, directly or indirectly of certain NBS services.

Principally calibration services, measurement, insurance programs services known as maps, and/or standard reference materials, SRM's. We therefore have firsthand knowledge of the critical nature of the NBS, its importance to industry, commerce, research, and defense. It is with this knowledge that I make the following remarks.

Research and development which supports the calibration services of the NBS, including measurement assurance programs and standard reference materials is, we believe, an organic act responsibility which has always been funded by the Congress. A nation's standards and their dissemination to industry, commerce and other parts of government, is the province of government. Research and development costs in support of that mission are correctly a governmental responsibility on behalf of the Nation as a whole.

The proposal that the costs for research and development which supports measurement assurance programs or standard reference materials should be recovered from its beneficiaries—users—has several flaws.

First, as noted previously, this research and development benefits the Nation as a whole in the near- and long-term future. It therefore should be a federally funded activity.

Second, even if one suggested that only the users of NBS services such as measurement assurance programs were the beneficiaries—which we reject—the users of existing measurement assurance programs or purchasers of an existing standard reference material are not the beneficiaries of current research and development.

The beneficiaries would be those who used that service after the research and development was completed. Although these users might be identifiable in the future, it is extremely unlikely that the number of such future use would occur, could be adequately or equitably estimated in any immediate year.

This particular budget item is not the only research and development supporting the measurement standards mission of the Bureau. It is not even the only research and development supporting measurement assurance programs. Thus, it appears that only one portion of the NBS activity in research and development is singled out for this peculiar treatment.

The NCSL is alarmed by the size and the areas of the budget cuts proposed for the NBS. At a time when leaders in both parties are suggesting the need for increased Federal attention to, and support for, high technology, this cut is not only inconsistent, it is counter-productive. Although my remarks are centered on two issues; funding of research and development for measurement assurance programs and standard reference materials, and training services related to fundamental physical measurements and standards, the NCSL is dismayed at the small size of the overall budget for the NBS and the implications that the reduction has for the vital mission of the Bureau.

We view this situation as extremely serious and believe that NBS is, and should remain, the preeminent technical asset of the Nation. As noted by Mr. Brungart in his message to our membership in the December issue of the NCSL Newsletter, "research and development, particularly within the NBS, must be viewed—as it has since the Bureau was created—as a national investment in the future. Research assures at least two important results. First, it leads to improved knowledge of measurement phenomena; to the capability to make consistent measurements which are required today and in the future, and, because of that knowledge and capability, to increased knowledge in science, technology, and commerce. Second, it provides the challenge to scientific inquiry which attracts the exceptionally high caliber of scientific, engineering, technical, and management personnel which have characterized the staff of the NBS for over 80 years."

In light of the above, the National Conference of Standards Laboratories strongly urges that the proposed budget cuts associated with MAPs, SRMs and training services related to fundamental physical measurements and standards not be implemented and that the previously identified funding be restored.

[The prepared statement of Mr. Keith follows:]

STATEMENT OF HARTWELL KEITH, ON BEHALF OF THE NATIONAL CONFERENCE OF STANDARDS LABORATORIES

Mr. Chairman and Members of the Subcommittee:

I wish to express my appreciation, and that of the National Conference of Standards Laboratories (NCSL), for the priviledge of appearing before you today. My name is Hartwell Keith, I am the President of NCSL, which is a non-profit organization with a membership in excess of 500 organizations and agencies having a strong interest, and direct participation in the field of Metrology and the operation of Calibration Laboratories. With me today are Dean Brungart, Immediate Past President, and George Rice, Executive Vice President.

As some of our members are governmental laboratories - in DoE, DoD, NASA, etc. - it is important that you understand that the Federal Government laboratories have made their views known to the NBS and - I believe - to their own parent organizations. These remarks are limited to the views of our industrial, commercial and other membership.

The majority of our members are users, directly or indirectly, of certain NBS services - principally calibration services, Measurement Assurance Program (MAP) services, and/or Standard Reference Materials (SRMs). We therefore have first-hand knowledge of the critical nature of the NBS - its importance to industry, commerce, research and defense. It is with this knowledge that I make the following remarks.

We have been informed that the NBS budget will be reduced in three important areas: $1.93M for the continuation of research and development in support of Measurement Assurance Programs, $0.43M for similar support for SRMs, and $.06M for training services related to fundamental physical measurements and standards. The reason for these reductions is stated to be the policy of the current Administration that identifiable beneficiaries should bear the full cost of the government services they use through fees charged. We believe in this policy in which beneficiaries pay for services they use. In the case of calibration services, MAPs, or SRMs, the beneficiaries have always paid fees which recovered the operational costs of these services. We have not found fault with this practice.

Research and development which supports the calibration services of the NBS (including Measurement Assurance Programs and Standard Reference Materials) is, we believe, an Organic Act responsibility which has always been funded by the Congress. A nation's standards and their dissemination to industry, commerce, and other parts of government, is the province of government. Research and development costs in support of that mission are correctly a governmental responsibility on behalf of the nation as a whole.

By way of background, the Measurement Assurance Program is one which, although conceived some years ago, is still in its infancy. Scientific achievements over the past fifteen years have dictated that the National Measurement System can no longer be sustained through the past practice of placing devices, which were calibrated by the NBS, in the hands of skilled technicians and scientists - with an expected result of accomplishing measurement accuracies required. Today's and tomorrow's technology demands that total measurement system performance be evaluated and known to precisions previously unattainable, and in new fields of science previously explored in theory only, such as lasers, optical fibers, and millimeter waves. The Measurement Assurance Program specifically addresses this new requirement in that it involves not only the device or instrument but also the techniques and total environment in which the measurements are made.

The proposal that the costs for research and development which supports Measurement Assurance Programs or Standard Reference Materials should be recovered from its beneficiaries (users) has several flaws.

First, as noted previously, this research and development benefits the nation as a whole in the near and long term future. It therefore should be a Federally-funded activity.

Second, even if one suggested that only the users of NBS services such as Measurement Assurance Programs were the beneficiaries - which we reject - the users of existing Measurement Assurance Programs or purchasers of an existing Standard Reference Material are not the beneficiaries of current research and development. The beneficiaries would be those who used that service after the research and development was completed. Although these users might be identifiable in the future, it is extremely unlikely that the number of such future users, or the time period over which such future use would occur, could be adequately or equitably estimated in any immediate year. This particular budget item is not the only research and development supporting the measurement standards mission of the Bureau. It is not even the only research and development supporting Measurement Assurance Programs. Thus, it appears that only one portion of the NBS activity in research and development is singled out for this peculiar treatment.

The NCSL is alarmed by the size and the areas of the budget cuts proposed for the NBS. At a time when leaders in both parties are suggesting the need for increased Federal attention to - and support for - high technology, this cut is not only inconsistent, it is counter-productive. Although my remarks are centered on two issues - funding of research and development for Measurement Assurance Programs and Standard Reference Materials, and training services related to fundamental physical measurements and standards - the NCSL is dismayed at the small size of the overall budget for the NBS and the implications that the reduction has for the vital mission of the Bureau.

We view this situation as extremely serious and believe that NBS is, and should remain the preeminent technical asset of the nation. As noted by Mr. Brungart in his message to our membership in the December issue of the NCSL Newsletter, "research and development, particularly within the NBS, must be viewed (as it has since the Bureau was created) as a national investment in the future. . . Research assures at least two important results. First, it leads to improved knowledge of measurement phenomena; to the capability to make consistent measurements which are required today and in the future, and (because of that knowledge and capability) to increased knowledge in science, technology, and commerce. Second, it provides the challenge to scientific inquiry which attracts the exceptionally high caliber of scientific, engineering, technical and management personnel which have characterized the staff of the NBS for over eighty years."

In light of the above, the National Conference of Standards Laboratories strongly urges that the proposed budget cuts associated with MAPs, SRMs, and training services related to fundamental physical measurements and standards not be implemented and that the previously identified funding be restored.

Thank you.

Mr. **Brown**. I presume that your colleagues agree with your statement?

Mr. **Keith**. Absolutely.

Mr. **Brungart**. We have improved our measurements greatly in the last 20 years and most of our technical growth can be attributed to our improved measurements and it is only through measurements that we can predict or control the quality of our products, and at a time that we are suffering in the United States for lack of quality, I think now is the time to reduce our measurement research and development.

Mr. **Keith**. If there is a consideration that the administration or whoever else feels that private industry can afford, or that the nation can afford independent research which could only be conducted by the larger, more affluent defense-oriented private organizations, this is not a feasible approach.

We would have 2, 3, 8, or 10 organizations proceeding on their own to develop a process or standard which in no way would necessarily be related to what the other companies were pursuing and it would be like reinventing the wheel or a new device that is undefinable with a multitude of funds.

Mr. **Brown**. Well, I think you will recognize that in appearing before this subcommittee, you are appearing before a group that largely tends to agree with you. I don't think we have any difference with the basic concept of cost recovery for services where there are identifiable costs and benefits to a particular group, but there are several complications to this; which your statement properly outlines and we appreciate that and what we are trying to do in this hearing is to establish a record for making a balanced judgment in this situation, and to the degree that the services there partake of the characteristics of basic research; for example, the Federal Government funds basic research because there is no way of recovering directly the cost of basic research.

To the degree that it enhances the quality of American productivity, we are, as you pointed out, we are vitally interested in achieving that goal and to take a step that would be counterproductive to that would not be in the national interests but we need a clearly enunciated record which will allow us to preach this gospel to our colleagues who don't have the opportunity to hear your testimony and that of the other witnesses that we have heard this morning.

There is an interesting comparison. In the desire to recover costs and priorities the number of activites, the administration is proposing to sell off the meteorological and Landsat satellites, and as I understand it, they are preparing to buy back their services at a subsidiary.

How does that compare to what they are proposing in this situation?

Mr. **Keith**. In that situation, as you know, the extent of the cost was unrealistically assessed as being available to be purchased by the private community or the defense industries. However, that is or those are one private type devices, the building of which and successful carrying out of the mission, depends on basic standards.

What we are concerned with here are the basic standards and advanced and development techniques of the basic standards which serve the country in all areas, so we are talking about the very underpinning of all the measurements that are and will be made in relation to all the testimony that was made today and all the various technologies and fields of scientific research.

Mr. Brown. Mr. Walgren, do you have any questions?

Mr. Walgren. No.

Mr. Brown. Gentlemen, we thank you very much for your testimony. It has been very helpful to us.

I would like to call Dr. Robert Pry at this time; Dr. Pry.

Dr. Pry is cochairman of the National Laboratories subcommittee of the Industrial Research Institute, a very prestigious organization representing the research interests of most of the major corporations of the country, and we very much appreciate your being here this morning, Dr. Pry, and value your testimony very much.

STATEMENT OF DR. ROBERT H. PRY, COCHAIRMAN, NATIONAL LABORATORIES SUBCOMMITTEE, INDUSTRIAL RESEARCH INSTITUTE, AND VICE CHAIRMAN-TECHNOLOGY, GOULD, INC., CHICAGO, ILL.

Dr. Pry. Thank you, Mr. Chairman.

My name is Robert Pry and I am vice chairman-technology at Gould, Inc., a major producer of electronic equipment. Our headquarters are just northwest of Chicago in Rolling Meadows. The company has in the past, and continues to take positions, not only in support of its own interests, but also on important issues relevant to the national interest.

I have personally taken active interest in the role of Federal R&D in catalyzing national economic growth. I am a member of the Energy Research Advisory Board of DOE and head of its Materials R&D Panel. I am a member of the National Science Foundation's industrial panel on science and technology and cochairman of the Industrial Research Institute committee on National Laboratory-industry interactions, a committee that combines leading commercial R&D executives and National Laboratory directors, including the National Bureau of Standards.

I will be speaking on the question of the whole Federal R&D budget at the American Association for the Advancement of Science meeting here in Washington. I am sharing the podium with Jay Keyworth, who has perhaps some different views than mine.

At this time, almost everyone inside and outside of government can agree that a carefully directed research and development program and its rapid incorporation into useful goods and services in our society is vital to our regaining not only our domestic economic momentum, but also our leadership position among the advanced countries of the world.

Where the confusion and disagreement occurs is in the proper direction of the research and the balance between short and long range efforts. In particular the balance between basic research and engineering development efforts in the Federal sector. In no place is this confusion more evident than in the current budget submission for the Bureau of Standards.

I am among the strong supporters of the notion that Federal agencies should not engage in development efforts that are better done in the private sector and that Federal in-house R&D should not dominate national R&D efforts. Let us not, however, allow such general ideas to cloud our vision of the nature of the R&D and product development process.

I recently studied the National Bureau of Standards budget submission and I read Professor Dresselhaus' recent testimony to the Senate Commerce, Science, and Transportation Committee on this budget. She is chairman of the National Bureau of Standards evaluation panel. Her testimony is very detailed and I commend it to you since I agree with most of it. I expect, however, to be somewhat more brief in my remarks.

The Bureau's budget is being curtailed in several areas, but let me use only a few to illustrate my position. First, let us examine the areas of fire research and building research; areas where the Bureau has excelled in recent years.

These areas, which are both scheduled for elimination in the 1984 budget, are good examples of the proper Federal role in engineering research. Building design, materials, and construction or renovation are highly fragmented industries in the United States. Nonetheless, they are areas of vital national interest, not only from an economic, but also from human safety and quality of life point of view.

In the case of highly fragmented and dispersed industry such as this, there is a critical need for a concentrated transition effort between applied research and industry practice. Such an effort is needed to incorporate our advances in science and technology into design principles and suggested practices that can be used in public building codes and industry engineering standards. Such is the purpose of this National Bureau of Standards program.

If I may use a homely analogy which I think you used a little while ago, with the farm industry can you imagine 30 to 50 years ago, or today for that matter, anyone seriously making the case that American agriculture would gain and keep world leadership by doing basic biology research and getting rid of the crop and husbandry developments of our Agriculture Department and abolishing the concept of the county agent? I submit to you that the decimation of the National Bureau of Standards program on building and fire research is a very similar irrationality.

Next, I would like to consider briefly the area of automated manufacturing research, an area that is being cut back significantly in direct National Bureau of Standards support. Here again one might argue that since 50 percent of U.S. manufacturing is accomplished by 2 to 3 percent of firms in manufacturing, that this effort is best left up to industry.

Let me quickly point out, however, that the other side of that statistic is that the other 50 percent of U.S. manufacturing is accomplished in manufacturing establishments of 500 people or less, units too small to develop their own automation R&D. Indeed, if we look at that area of traditional strength in the United States versus foreign countries, it lies in the rapid acceptance of new technology by our smaller firms after it is packaged in a way that they can use it.

This brings me to my final points. The need to keep an eye, not only on the amount of our R&D expenditures, but also on the balance of the time horizons of our various R&D programs. We are in critical times of technology challenges around the world. Let us be sure we understand what that challenge is. No one, to my knowledge, is seriously challenging U.S. leadership in basic understanding in science. Yes, we are facing a critical shortage of scientists and engineers for the future and we must remedy that. The critical near term challenge, however, lies in our ability to translate that science quickly and effectively into products and services of national economic importance.

If my assertion is correct, I find it puzzling that the one department marked for the largest percentage decrease in R&D is the Department of Commerce, whose record, particularly at the Bureau, for providing technical results useful to industry, per dollar spent, is unsurpassed by any other Government department or agency.

Let me state this conviction again as clearly as I can. Given the efficiency of modern international communications, basic research produced anywhere in the free world is equally accessible to all nations possessing some advance scientific talent. Basic research raises the level of the lake in which we all float but it does not provide for me a way to float higher than the rest of the nations.

The real leader among nations will continue to be that one most capable of applying such knowledge and understanding rapidly to the economic betterment of their citizens. More than most Government organizations, that is the essence of the National Bureau of Standards effort. These are precisely the functions that are being curtailed or eliminated.

I would be happy to expand upon these remarks now in response to your questions, or later if desired.

[The prepared statement of Dr. Pry follows:]

TESTIMONY
BY
ROBERT H. PRY
VICE CHAIRMAN-TECHNOLOGY
GOULD INC.

GOOD MORNING MR. CHAIRMAN. MY NAME IS ROBERT PRY AND I AM VICE CHAIRMAN-TECHNOLOGY AT GOULD INC., A MAJOR PRODUCER OF ELECTRONIC EQUIPMENT. OUR HEADQUARTERS ARE JUST NORTHWEST OF CHICAGO IN ROLLING MEADOWS. THE COMPANY HAS IN THE PAST, AND CONTINUES TO TAKE POSITIONS, NOT ONLY IN SUPPORT OF ITS OWN INTERESTS, BUT ALSO ON IMPORTANT ISSUES RELEVANT TO THE NATIONAL INTEREST.

I HAVE PERSONALLY TAKEN ACTIVE INTEREST IN THE ROLE OF FEDERAL R&D IN CATALYZING NATIONAL ECONOMIC GROWTH. I AM CURRENTLY A MEMBER OF THE ENERGY RESEARCH ADVISORY BOARD OF DOE AND HEAD OF ITS MATERIALS R&D PANEL. I AM A MEMBER OF THE NATIONAL SCIENCE FOUNDATION'S INDUSTRIAL PANEL ON SCIENCE AND TECHNOLOGY AND CO-CHAIRMAN OF THE INDUSTRIAL RESEARCH INSTITUTE COMMITTEE ON NATIONAL LABORATORY/INDUSTRY INTERACTIONS, A COMMITTEE THAT COMBINES LEADING COMMERCIAL R&D EXECUTIVES AND NATIONAL LABORATORY DIRECTORS, INCLUDING THE NATIONAL BUREAU OF STANDARDS.

NOTWITHSTANDING THESE RELATIONSHIPS, IT SHOULD BE UNDERSTOOD THAT THE TESTIMONY I AM ABOUT TO GIVE DOES NOT REPRESENT THE POSITION OF ANY OF THESE NAMED ORGANIZATIONS, BUT IS A REPRESENTATION OF MY OWN VIEWS, BASED UPON, AMONG OTHER THINGS, THESE ASSOCIATIONS.

AT THIS TIME, ALMOST EVERYONE INSIDE AND OUTSIDE OF GOVERNMENT CAN AGREE THAT A CAREFULLY DIRECTED RESEARCH AND DEVELOPMENT PROGRAM AND ITS RAPID INCORPORATION INTO USEFUL GOODS AND SERVICES IN OUR SOCIETY IS VITAL TO OUR REGAINING NOT ONLY OUR DOMESTIC ECONOMIC MOMENTUM, BUT ALSO OUR LEADERSHIP POSITION AMONG THE ADVANCED COUNTRIES OF THE WORLD.

WHERE THE CONFUSION AND DISAGREEMENT OCCURS IS IN THE PROPER DIRECTION OF THE RESEARCH AND THE BALANCE BETWEEN SHORT AND LONG RANGE EFFORTS, IN PARTICULAR THE BALANCE BETWEEN BASIC RESEARCH AND ENGINEERING DEVELOPMENT EFFORTS IN THE FEDERAL SECTOR. IN NO PLACE IS THIS CONFUSION MORE EVIDENT THAN IN THE CURRENT BUDGET SUBMISSION FOR THE BUREAU OF STANDARDS.

I AM AMONG THE STRONG SUPPORTERS OF THE NOTION THAT FEDERAL AGENCIES SHOULD NOT ENGAGE IN DEVELOPMENT EFFORTS THAT ARE BETTER DONE IN THE PRIVATE SECTOR AND THAT FEDERAL IN HOUSE R&D SHOULD NOT DOMINATE NATIONAL R&D EFFORTS. LET US NOT, HOWEVER, ALLOW SUCH GENERAL IDEAS TO CLOUD OUR VISION OF THE NATURE OF THE R&D AND PRODUCT DEVELOPMENT PROCESS.

I RECENTLY STUDIED THE NATIONAL BUREAU OF STANDARDS BUDGET SUBMISSION AND I READ PROFESSOR DRESSELHAUS' RECENT TESTIMONY TO THE SENATE COMMERCE, SCIENCE AND TRANSPORTATION COMMITTEE ON THIS BUDGET. SHE IS CHAIRMAN OF THE NATIONAL BUREAU OF STANDARDS EVALUATION PANEL. HER TESTIMONY IS VERY DETAILED AND I COMMEND IT TO YOU SINCE I AGREE WITH MOST OF IT. I EXPECT, HOWEVER, TO BE SOMEWHAT MORE BRIEF IN MY REMARKS.

THE BUREAU'S BUDGET IS BEING CURTAILED IN SEVERAL AREAS, BUT LET ME USE ONLY A FEW TO ILLUSTRATE MY POSITION. FIRST, LET US EXAMINE THE AREAS OF FIRE RESEARCH AND BUILDING RESEARCH; AREAS WHERE THE BUREAU HAS EXCELLED IN RECENT YEARS.

THESE AREAS, WHICH ARE BOTH SCHEDULED FOR ELIMINATION IN THE 1984 BUDGET, ARE GOOD EXAMPLES OF THE PROPER FEDERAL ROLE IN ENGINEERING RESEARCH. BUILDING DESIGN, MATERIALS, AND CONSTRUCTION OR RENOVATION ARE HIGHLY FRAGMENTED INDUSTRIES IN THE UNITED STATES. NONETHELESS, THEY ARE AREAS OF VITAL NATIONAL INTEREST, NOT ONLY FROM AN ECONOMIC, BUT ALSO FROM HUMAN SAFETY AND QUALITY OF LIFE POINT OF VIEW.

IN THE CASE OF HIGHLY FRAGMENTED AND DISPERSED INDUSTRY SUCH AS THIS, THERE IS A CRITICAL NEED FOR A CONCENTRATED TRANSITION EFFORT BETWEEN APPLIED RESEARCH AND INDUSTRY PRACTICE. SUCH AN EFFORT IS NEEDED TO INCORPORATE OUR ADVANCES IN SCIENCE AND TECHNOLOGY INTO DESIGN PRINCIPLES AND SUGGESTED PRACTICE THAT CAN BE USED IN BUILDING CODES AND INDUSTRY ENGINEERING STANDARDS. SUCH IS THE PURPOSE OF THIS NATIONAL BUREAU OF STANDARDS PROGRAM.

IF I MAY USE A HOMELY ANALOGY WITH THE FARM INDUSTRY, CAN YOU IMAGINE THIRTY TO FIFTY YEARS AGO -- OR TODAY FOR THAT MATTER -- ANYONE SERIOUSLY MAKING THE CASE THAT AMERICAN AGRICULTURE WOULD GAIN AND KEEP WORLD LEADERSHIP BY DOING BASIC BIOLOGY RESEARCH AND GETTING RID OF THE CROP AND HUSBANDRY DEVELOPMENTS OF OUR AGRICULTURE DEPARTMENT AND ABOLISHING THE CONCEPT OF THE COUNTY AGENT? I SUBMIT TO YOU THAT THE DECIMATION OF THE NATIONAL BUREAU OF STANDARDS PROGRAM ON BUILDING AND FIRE RESEARCH IS A VERY SIMILAR IRRATIONALITY.

NEXT, I WOULD LIKE TO CONSIDER BRIEFLY THE AREA OF AUTOMATED MANUFACTURING RESEARCH, AN AREA THAT IS BEING CUT BACK

SIGNIFICANTLY IN DIRECT NATIONAL BUREAU OF STANDARDS SUPPORT. HERE AGAIN ONE MIGHT ARGUE THAT SINCE 50% OF UNITED STATE MANUFACTURING IS ACCOMPLISHED BY 2% OF UNITED STATES INDUSTRY, THAT THIS EFFORT IS BEST LEFT UP TO INDUSTRY. LET ME QUICKLY POINT OUT, HOWEVER, THAT THE OTHER SIDE OF THAT STATISTIC IS THAT THE OTHER 50% OF UNITED STATES MANUFACTURING IS ACCOMPLISHED IN MANUFACTURING ESTABLISHMENTS OF 500 PEOPLE OR LESS, UNITS TOO SMALL TO DEVELOP THEIR OWN AUTOMATION R&D. INDEED, IF WE LOOK AT THE AREA OF TRADITIONAL STRENGTH IN THE UNITED STATES VS FOREIGN COUNTRIES, IT LIES IN THE RAPID ACCEPTANCE OF NEW TECHNOLOGY BY OUR SMALLER FIRMS AFTER IT IS PACKAGED IN A WAY THAT THEY CAN USE IT.

THIS BRINGS ME TO MY FINAL POINT. THE NEED TO KEEP AN EYE, NOT ONLY ON THE AMOUNT OF OUR R&D EXPENDITURES, BUT ALSO ON THE BALANCE OF THE TIME HORIZONS OF OUR VARIOUS R&D PROGRAMS. WE ARE IN CRITICAL TIMES OF TECHNOLOGY CHALLENGES AROUND THE WORLD. LET US BE SURE WE UNDERSTAND WHAT THAT CHALLENGE IS. NO ONE, TO MY KNOWLEDGE, IS SERIOUSLY CHALLENGING UNITED STATES LEADERSHIP IN BASIC UNDERSTANDING IN SCIENCE. YES, WE ARE FACING A CRITICAL SHORTAGE OF SCIENTISTS AND ENGINEERS FOR THE FUTURE AND WE MUST REMEDY THAT. THE CRITICAL NEAR TERM CHALLENGE, HOWEVER, LIES IN OUR ABILITY TO TRANSLATE THAT SCIENCE QUICKLY AND EFFECTIVELY INTO PRODUCTS AND SERVICES OF NATIONAL ECONOMIC IMPORTANCE.

IF MY ASSERTION IS CORRECT, I FIND IT PUZZLING THAT THE ONE DEPARTMENT MARKED FOR THE LARGEST PERCENTAGE DECREASE IN R&D IS THE DEPARTMENT OF COMMERCE, WHOSE RECORD FOR PROVIDING TECHNICAL

RESULTS USEFUL TO INDUSTRY, PER DOLLAR SPENT,IS UNSURPASSED BY ANY OTHER GOVERNMENT DEPARTMENT OR AGENCY.

LET ME STATE THIS CONVICTION AGAIN AS CLEARLY AS I CAN. GIVEN THE EFFICIENCY OF MODERN INTERNATIONAL COMMUNICATIONS, BASIC RESEARCH PRODUCED ANYWHERE IN THE FREE WORLD IS EQUALLY ACCESSIBLE TO ALL NATIONS POSSESSING SOME ADVANCE SCIENTIFIC TALENT. THE REAL LEADER AMONG NATIONS WILL CONTINUE TO BE THAT ONE MOST CAPABLE OF APPLYING SUCH KNOWLEDGE AND UNDERSTANDING RAPIDLY TO THE ECONOMIC BETTERMENT OF THEIR CITIZENS. MORE THAN MOST GOVERNMENT ORGANIZATIONS, THAT IS THE ESSENSE OF THE NATIONAL BUREAU OF STANDARDS EFFORT. THESE ARE PRECISELY THE FUNCTIONS THAT ARE BEING CURTAILED OR ELIMINATED.

I WOULD BE HAPPY TO EXPAND UPON THESE REMARKS NOW IN RESPONSE TO YOUR QUESTIONS, OR LATER IF DESIRED.

Mr. **Brown**. Dr. Pry, I don't think we are going to have time to let you expand on those remarks this morning, but you have inspired me to want to catch your remarks tomorrow when you are appearing with Dr. Keyworth.

I may suggest that you trade jobs with Dr. Keyworth.

I think the Federal Government role would be enhanced by that, not that I would expect you to accept the trade.

Dr. **Pry**. I am not sure he would like to accept that either, and I am not sure I would like to accept his money.

Mr. **Brown**. Well, what we obviously need at this particular point in time is someone who has a perspective that your statement demonstrates as to what the real needs of this country are, if we are to reestablish our economic industrial leadership in the world.

We cannot do that by arbitrarily renouncing programs which contribute to the improvement of that industrial base, and the infrastructure base and other related kinds of activities.

We have to make such policy changes in an extremely discriminating way, and I have failed to see evidence that we are exercising that kind of discrimination in the kind of budgetary decisions that are being made at the present time, and I have no objection to what I understand to be the philosophy in many of these cases.

I am not trying to enlarge the scope of Government. I am trying to make it more effective, and I think that has to be our goal.

Dr. **Pry**. Really, even though I am one of the executives in a Fortune 500 company, I would argue very strongly that this committee, when it looks at applied research and development in Government, to weigh heavily the efforts that are directed toward small industries in this country, and the development, if you like, or the application of science in a way that is useful to the small entrepreneur and engineer working either alone or in small groups.

That is the vital element of U.S. economic growth in which we excel far more than any other country in the world. Our Federal R&D role should, I think, have emphasis in the development area toward helping those fragmented and small industries grow and prosper.

Thank you.

Mr. **Brown**. Mr. Walgren.

Mr. **Walgren**. Mr. Brown, if I could underscore the testimony, and particularly the concept of the need for a concentrated need for a transition effort between applied research and industry practice.

Usually we find witnesses saying, Well, basic research is all right but we don't want you to be involved in applied research, and yet you are focusing on the need for a transition between applied and industry practice. I just think that deserves some real emphasis.

Dr. **Pry**. Yes, it does, Mr. Walgren. The thing that I mean there is the following: That my company, for example, or the General Electric Co., we have laboratories of several hundred people and we have no problem personally in making that transition; for companies in the Fortune 500 or 1,000, that is not an issue but if you look at what happens, Apple Computer, a score of small what used to be small industries who create most of the jobs in this country and create most of the growth in our economics, they do not have the possibility really of undertaking that transition themselves from the very basic work that is done in most of the Federal laboratories and packaging it in a way to use it.

In small, fragmented industries, it is really up to this committee to look hard at how you can help your own constituents as they grow and prosper and start to grow.

Mr. WALGREN. They are recommending budget cuts.

Can you give us any measure of the adequacy of our program in the past in this area?

Dr. PRY. The Bureau, in my view, I have known the Bureau ever since I interviewed there in 1951, has an excellent laboratory. I have always personally felt that the BLS which one might say is the central industrial laboratory for U.S. business is very, very small by anybody's standards. If you look at where this country gets its strength, it is not just in the Defense Department but in our economic backbone which again I would say is due primarily to the formation and growth of small businesses in the United States, and personally, I think we are doing very, very little.

If you compare, for example, with the Agriculture Department, what was started in the 1850's and 1860's under Lincoln's direction of the land-grant college, county agents, experiment stations, whatnot and try to put that over into the context of commerce. We are doing very, very little.

Mr. BROWN. You are not introducing out a partisan note by making the point that Lincoln was a Republican.

Dr. PRY. Thomas Jefferson said the strength of a country is in its intellectual assets, not its mineral assets. That will balance it off.

Mr. WALGREN. I just feel we all ought to take the admonition not to let general ideas cloud our vision at this point in our national history and I think that these words are well chosen.

Thank you, Mr. Chairman.

Mr. BROWN. Thank you very much, Dr. Pry.

Next, Dr. Myron Tribus, chairman of the Technology Task Force, National Society of Professional Engineers. We welcome you here.

We know your own extensive background in the subject matter covered by this hearing.

STATEMENT OF DR. MYRON TRIBUS, CHAIRMAN, TECHNOLOGY POLICY TASK FORCE, NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS; DIRECTOR, MIT CENTER FOR ADVANCED ENGINEERING STUDY; AND FORMER ASSISTANT SECRETARY OF COMMERCE FOR SCIENCE AND TECHNOLOGY

Dr. TRIBUS. I have deposited with the committee the written testimony and I will only hit the highlights at this point.

I would like to make two points before getting to the budget. First, I would like to sketch broadly what it takes to be competitive in international trade. It takes two major thrusts. These are concerned with what we make and how we make it. What we make is determined by what we do in the way of invention and innovation and how we make it is determined by the quality and productivity of our people.

Both of these require initiatives in the private sector. They require a creative response. They require certain competencies, a certain infrastructure, and the prior existence of certain practices and procedures. In going to the marketplace, it requires a mix of technology, law, economics, and business.

Any concern that we have for greater competitiveness must be concerned with these two thrusts, invention and innovation on the one hand, quality and productivity on the other.

The second issue or the second point is the role of Government. There are so many opinions today concerning what the Government should or should not do and these range all the way from laissez-faire to centralized planning. We believe that looking at it either as a choice between those two will confuse us. We believe that the role of the Government is not as planner but as catalyst and in order that the Government can function as a catalyst, we believe there are five things that need to be taken into account.

The Government must establish an appropriate forum which will be free of legal constraints such as would be imposed by the Justice Department in view of the antitrust laws of this country, a forum in which all who are concerned can get together and discuss their mutual opportunites and difficulties and problems.

Such a forum must be supported by a well-maintained and organized data base, a data base that is concerned and responsive to the problems that emerge from these forums, not just a data base that is determined on the basis of history.

We have always gathered this information. We need to keep publishing it.

That attitude doesn't hold today.

Third, there must be analyses of the data and these analyses, their methods, their sources, their techniques need to be discussed and debated.

The data base and the analyses form the basis for the forum and the forum can form the basis for the needed data taking and analytical work, and also there must be an ability to foster plans of action; that is, to aid those in the private sector that would form new arrangements, and there need to be ways to coordinate the activities of the Government itself in removing identified barriers.

Another requirement is that the work be sensitive to the needs of all parties, not just business leaders, but labor, the States, and academia.

Above all, there must be integrity in what is done.

Now, turning to the budget, we note that the Assistant Secretary for Productivity, Technology and Innovation is part of the Office of the Under Secretary for Economic Affairs and in looking at the budget, I began with that.

The budget for the Under Secretary's activities is $38.9 million in fiscal year 1984.

Within there, the Assistant Secretary for Productivity, Technology and Innovation has a budget of about $3 million, somewhat less than 10 percent.

The Office of Productivity, Technology and Innovation is described as having the following goal: The goal of this activity is to stimulate U.S. private sector productivity, international competitiveness and economic growth. This activity is responsible for providing a favorable climate for private sector cooperative research and development, facilitating commercialization of innovations, supporting private sector productivity improvement efforts and eliminating policy barriers to improve international competitiveness and that is certainly an excellent goal.

The question now arises is, How well is it supported? Does it serve as the kind of catalyst that I described earlier? Is it not always easy to tell from the dry reading of the budget, but I have had a little experience from that office and interviewed a number of people in and out of Commerce and what I say now will represent some of that experience.

I note that the Under Secretary for Economic Affairs has reporting to him the Chief Economist, the Bureau of Industrial Economics, and the Bureau of Economic Analysis. These form the nontechnical side of his "house." On the other side we find the Office of the Assistant Secretary for Productivity, Technology and Innovation, the Office of Competitive Assessment, and the Office of Strategic Resources.

The budget devoted to work with a strong technical flavor is less than 10 percent of the total. When we compare this effort with that of our principal competitor, Japan, using any basis; money, people, resources, influence; it is hard to believe that our Government is in a position to be helpful to our industry in anything like comparable measure.

Although the budget indicates that the efforts under the Under Secretary are "coordinated" it is difficult to see the evidence of this coordination. To begin with, the Under Secretary just does not have the support to achieve such coordination. It is true that the Assistant Secretary relies upon the other agencies wherever he can, but he is a long way from influencing what priorities they attach to their work or guiding their efforts.

People who are not technically qualified do not know what to measure to be in a position to say something about the effects of technology in business planning. It is hard enough to do when you are qualified; impossible when you are not.

When J. Herbert Hollomon was Assistant Secretary in the Department of Commerce, he created the Commerce Technical Advisory Board—CTAB—to provide a combination of technical and business perspective on the work of the Department. Whenever a problem was considered by CTAB, it was possible to combine the inputs from bureaus and agencies of Government with the expertise of experts outside the Government.

We believe that something like CTAB should now be reporting to the Under Secretary's office. The members of CTAB were leaders in the development and application of technology in the private sector. They were able to identify and attract to subcommittees the most able people to assist in the evaluation of the output of the agencies. This kind of influence is missing from the current setup.

The current Assistant Secretary is the sort of person who probably would have qualified for CTAB, so nothing I say should be taken as a criticism of him. But no one is broadly enough experienced or educated to understand the problems of each and every industry. Without this outside input it is unlikely that OPTI will be able to generate the kinds of data needed to influence the decisions of the private sector.

Dr. Merrifield has produced an anlaysis of the petrochemical industry. It is a good contribution, but, as I am sure he himself would say, it does not go far enough in delving into the problems and opportunities in petrochemicals. I think he would be among the first to say so.

I note that the most important conclusions in his report are attributed to the output of a proprietary computer program. This means that the essential part of the report has not been independently checked. I am confident that when they are checked, they will be found to be correct. But if I were an industrialist who ought to change my plans because of the report, I would certainly like to know more about how the numbers were developed. Before spending money to duplicate the results, I would like to know how the DOC results were obtained.

I wouldn't like to have to go back and repeat everything in order to just satisfy my curiosity as to whether this makes sense.

Additional studies are required before anyone could decide what Federal policies need to be changed. I understand that such studies are planned for the future. They ought to be developed with outside influence, especially from the industry most affected. They should be considered ongoing activities, not something that is done once and reported and put on the shelf and picked up 5 years from now.

Again, I wish to emphasize, we are not calling for a national plan. But it should be evident that if the Government is to serve as catalyst, it will be because its studies are so comprehensive and credible that the readers will understand and believe in the reality of their situation.

Let me close with an example of the kind of study which I believe should be made by the Department of Commerce, using all of its resources. I don't like the idea of deciding sunrise and sunset industries. We have some very successful industries in the United States which by almost any study would have been called sunset industries, and I refer to Proctor & Gamble, whose line of products would all represent very, very mature products.

Nevertheless, they use extraordinarily high technology in their manufacture and they are a competitive force throughout the world. It is not up to the Government to decide they are a sunset industry. That is up to the people at Proctor & Gamble and their competitors to decide.

If there is a difficulty in their industry, they should be allowed to get together with other segments of the industry to decide what is missing or what needs to be done in fundamental research or in education or in the removal of barriers, particularly when they try to make more sophisticated and more advanced production equipment and production machinery; they may indeed find a reason to cooperate, if they wish to.

I thought I would just pick a topic, robotics, and talk about what has to be done in that field and how I think the Department of Commerce might interact with it.

The rate at which robots are being introduced into U.S. industry lags considerably behind Japan, which already has a healthy lead on us in productivity and quality. Do we understand why this is so and what our options are in dealing with it?

Are we dealing with: Too few engineers? Inadequately trained engineers? Harmful labor/management relations which prevent the introduction of automation? Financial barriers, poor managerial practices? Workers fear of being laid off? Inadequate technology?

Only the Department of Commerce can foster the wide-ranging discussion of these questions, the development of coherent data bases, the analyses prompted by the discussions and the engagement of all portions of the government which might play a role.

The requirements for these studies are different, for example, from those made by the OTA. In the OTA the objective is to advise the Congress. In the forums we are proposing, the objective is to provide information, not advice, to the people who must make up their own minds as to what they are going to do.

In closing, I would also like to note that the Department budget reveals no funds to support the generic research called for in the Stevenson-Wydler Act. The existence of such research would be a useful adjunct to the other activities we have described. Such research can return to the Treasury many times the investment.

In 1969, I sponsored a study by the Arthur D. Little Co. which demonstrated that the money spent on the Office of State Technical Services was returned to the Treasury in the year it was spent. Cutting that agency out of the budget actually reduced the net income to the Government. That is, it increased the deficit. It did not decrease it.

Generic technology has the same potential, and we are sorry to see it languish.

There exists a very interesting report by a stock analyst and I will have the name in a moment, which points out that the spending on R&D by MITI corresponds to about 2 percent of the Japanese total. In the United States, it is about 30 percent. Their money is spent in ways that relate to the commercial objectives of Japanese industry, and that money is spent after considerable consultation and discussion. In fact, the people in MITI often float in and out of industry; so that they are very much aware of what is going on.

We spend more and get less because we have not coordinated the work of our Government with the interests of our industry.

Thank you.

[The prepared statement of Dr. Tribus follows:]

TESTIMONY OF MYRON TRIBUS, PE

NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

I am Myron Tribus, Director of the Center for Advanced Engineering Study at MIT. I have been an executive in industry, serving four years as Senior Vice President for Research and Engineering at the Xerox Corporation. I have served as Assistant Secretary of Commerce for Science and Technology. For eight years I was Dean of the Thayer School of Engineering at Dartmouth College. Before that I was a Professor of Engineering at UCLA. I have worked as an engineer in industry and served as a Design and Development Officer in the Air Force as a Captain. I am a member of the National Academy of Engineering and of the National Society of Professional Engineers, whom I represent today. My views do not necessarily represent the views of MIT.

I am pleased to have been invited to comment on the budget of the Assistant Secretary for Productivity, Technology and Innovation. While the title of the office has changed, and along with it some of its responsibilities, the problems faced there are not too different from 14 years ago. What has changed is the urgency with which the problems are now regarded.

Before commenting on the budget and organization of that office, let me first say a few words abut the task facing this Nation in attempting to regain its international competitiveness. Two thrusts are needed:

1. Invention/Innovation: New goods and services need to be introduced to take into account new needs, new desires, new developments in technology and new discoveries in science.

2. Quality/Productivity: New approaches to manufacturing technologies and new approaches to the management of systems of people and machines need to be put in place.

Both of these thrusts depend upon the health and vitality of our industry. These, in turn, dpend upon an extensive infrastructure involving education, finance, professions, and the government at all levels. Applying new technology is not just a matter of economics, or technology, or of business; it is all of these, treated in an integrated fashion.

Because there are so many different opinions about the role of the Federal Government in fostering international competitiveness, let me say a few words about what we believe this responsibility is and how it can best be discharged.

This responsibility can best be described in one word, "catalyst". To play this role the Government should do three things:

1. Provide a forum in which representatives of Business, Government, Labor and Academia may meet to discuss their common problems and opportunities, without fear of prosecution under the various anti-trust laws. We are not calling for wholesale repeal of those laws but we do believe that the circumstances in international and domestic commerce have changed drastically since those laws were formulated. New circumstances require new solutions. To discover what these solutions may be we are calling on the Government

to sponsor forums in which common problems may be freely discussed.

2. Provide a data base that is adequate to support the discussions at the forum. This data base can be a composite of the many data bases now available around the country as well as the data base compiled by the Government itself. Only the Federal Government is in the position to provide a consistent data base and to pull the information together in a consistent form, responsive the needs of the forum.

3. Provide analyses of the data. These analyses should be developed in response to the needs uncovered at the forums (or in advance of them). The analytical work should be critiqued by experts outside the Government. It is essential that the information and analyses developed be of unimpeachable integrity if they are to be used to develop Government policy.

The examinations should be carried out on an industry-by-industry basis.

We most emphatically do not believe that the Federal Government should develop a national plan. It is not for the Government to decide which are the "sunrise" and which are the "sunset" industries. The planning process belongs to the private sector. In an era in which our industrial trading partners allow and even encourage businesses to work together, we cannot continue to prohibit companies from sharing information about general conditions, especially about threats from abroad and about common opportunities and problems.

Now let us turn our attention to the budget and organization of the the Assistant Secretary for Productivity, Technology and Innovation and the associated offices. His offices are part of the Office of the Undersecretary for Economic Affairs. The total budget for these offices is described in the Economic and Statistical Analysis Account (ESA) of the Department of Commerce portion of the Federal Budget. The FY 1984 budget request for the entire ESA account is 38.90 million dollars.

According to the budget the goal of OPTI is:

> "The goal of this activity is to stimulate U.S. private sector productivity, international competitiveness and economic growth. This activity is responsible for providing a favorable climate for private sector cooperative research and development, facilitating commercialization of innovations, supporting private sector productivity improvement efforts, and eliminating policy barriers to improved international competitiveness."

That is a goal worthy of support. How well is it supported? Does the office serve as a "catalyst"?

The Undersecretary for Economic Affairs has reporting to him the Chief Economist, the Bureau of Industrial Economics, and the Bureau of Economic analysis. These form the non-technical side of his "house". On the other side we find the Office of the Assistant Secretary for Productivity, Technology and Innovation, the Office of Competitive Assessment, and the Office of Strategic Resources. The budget devoted to work with a strong technical flavor is less than 10% of the total. When we compare this effort with that of our principle competitor, Japan, using any basis, money, people, resources, influence, it is hard to believe that our Government is in a position to be helpful to our industry in anything like comparable measure.

Although the budget indicates that the efforts under the Undersecretary are "coordinated" it is difficult to see the evidence of this coordination. To begin with, the Undersecretary just does not have the support to achieve such coordination. It is true that the Assistant Secretary relies upon the other agencies wherever he can, but he is a long way from influencing what priorities they attach to their work or guiding their efforts. People who are not technically qualified do not know what to measure to be in a position to say something about the effects of technology in business planning. It is hard enough to do when you are qualified; impossible when you are not.

When J. Herbert Hollomon was Assistant Secretary in the Department of Commerce he created the Commerce Technical Advisory Board (CTAB) to provide a combination of technical and business perspective on the work of the Department. Whenever a problem was considered by CTAB, it was possible to combine the inputs from bureaus and agencies of Government with the expertise of experts outside the Government. We believe that something like CTAB should now be reporting into the Undersecretary's office. The members of CTAB were leaders in the development and application of technology in the private sector. They were able to identify and attract the most able people to assist in the evaluation of the output of the agencies. This kind of influence is missing from the current setup.

The current Assistant Secretary is the sort of person who probably would have qualified for CTAB, so nothing I say should be taken as a criticism of him. But no one is broadly enough experienced or educated to understand the problems of each and every industry. Without this outside input it is unlikely that OPTI will be able to generate the kinds of data needed to influence the decisions of the private sector.

Dr. Merrifield has produced an analysis of the petrochemical industry. It is a good contribution, but, as I am sure he himself would say, it does not go far enough in delving into the problems and opportunities in petrochemicals. I note that the most important conclusions in his report are attributed to the output of a "proprietary computer program". This means that the essential part of the report has not been independently checked. I am confident that when they are checked, they will be found to be correct. But if I were an industrialist who ought to change my plans because of the report, I would certainly like to know more about how the numbers were developed. Before spending money to duplicate the results, I would like to know how the DoC results were obtained.

Additional studies are required before anyone could decide what Federal policies need to be changed. I understand that such studies are planned for the future. They ought to be developed with outside influence, especially from the industry most affected.

Again, I wish to emphasize, we are not calling for a national plan. But it should be evident that if the government is to serve as catalyst, it will be because its studies are so comprehensive and credible that the readers will understand and believe in the reality of their situation.

Let me close with an example of the kind of study which I believe should be made by the Department of Commerce, using all of its resources.

ROBOTICS

The rate at which robots are being introduced into US industry lags considerably behind Japan, which already has a healthy lead on us in productivity and quality. Do we understand why this is so and what our options are in dealing with it? Are we dealing with:

Too few engineers?
Inadequately trained engineers?
Harmful labor/management relations?
Financial barriers?
Poor managerial practices?
Workers fear of being laid off?
Inadequate technology?

Only the Department of Commerce can foster the wide ranging discussion of these questions, the development of coherent data bases, the analyses prompted by the discussions and the engagement of all portions of the Government which might play a role.

The requirements for these studies are different, for example, from those made by the OTA. In the OTA the objective is to advise the Congress. In the forums we are proposing, the objective is to provide information, not advice, to the people who must make up their own minds as to what they are going to do.

In closing I would also like to note that the Department Budget reveals no funds to support the generic research called for in the Stevenson Wydler Act. The existence of such research would be a useful adjunct to the other activitie we have described. Such research can return to the treasury many times the investment. In 1969 I sponsored a study by the Arthur D. Little Company which demonstrated that the money spent on the Office of State Technical Services was returned to the treasury in the year it was spent. Reducing that part of the budget actually resulted in a net loss to the treasury. Generic technology has the same potential and we are sorry to see it languish.

Thank you.

Mr. **Brown**. Thank you for your excellent statement.

I would very much like to get a handle on the question of how much is enough to spend in this particular area. Of course, it is difficult to get to a figure when you have different philosophies of what you are trying to achieve or how you are going about achieving it.

You made reference to the Stevenson-Wydler Act, which was an effort to meet this problem of improving industrial innovation and productivity, and which was initially passed as a 5-year program with an authorized level of $285 million for the 5 years, as I recall, and, at the time, I thought that was a small enough figure, but that is extremely generous compared to what the efforts being budgeted in this administration are.

How can, or do you have any suggestions as to how we can determine what is a reasonable amount to try and provide that catalytical function that you described as the proper role of the Government?

Dr. **Tribus**. Your question really has two parts. One has to do with the provision of money for people to do the studies and prepare the data and reports, hold the meetings, and so on, and then there is another issue which is the appropriate amount of money that might be spent on generic R&D, and so on.

I will take those separately. When I was in this town, I had an awful time because anytime I proposed to spend less than $5 million, everybody concluded it must be a trivial program and not worth doing.

My inclinations are for modest sums of money which might grow over time in response to needs and demonstrated effectiveness.

I would like to see there is an advisory board, national technical board, or some title like that, that was the analog of CTAB. I would like to see it staffed and reinstituted, and staffed with the right kinds of people who are effective and industrial leaders and have them start looking at the holding of these industry-by-industry meetings and assessments.

Now, out of those meetings and assessments, we will find different things to do. We will always be a very small fraction of the amount of money spent by industry, but with a group of such people overseeing it, I could see where we would spend money. I doubt we would effectively spend $200 million in the first year.

I have been in Commerce and other parts of government, and I have seen what happens when you throw a lot of money into an agency. They have to figure out how to spend it before the year is out. I can visualize as time went on an increasing growth, but I would like to see the appropriate kind of analysis to show that something was coming back.

In previous materials that I have submitted to you, Mr. Chairman, I have described some of the deficiencies in the government approach to this problem.

We forget that we are on a learning curve. We seem to want people who will come and tell us exactly what to do and then we go do it and don't try to learn from the experience.

There are new techniques all over the world. For example, we want to have free trade so we agree with other people as to what constitutes free trade.

In those agreements we describe what is illegal in the way of a subsidy, what is improper in the way of special tax relief, so that people can identify whether they are dumping on the market, and so on.

All those things are worked out, and somebody invents a new form of unfair competition such as a government putting a lot of money into educating a lot of engineers, and then handing it off to somebody. Europeans told us that they could not compete in our aircraft industry because of the way we subsidize them.

Through military contracts, well, they became commercial competitors; that is happening all over the world, and in the last 30 years there is all this foreign competition. We need to go industry-by-industry, find out what is going on, and within each industry do whatever makes sense in a cooperative way between the government, and people in industry don't want the government spending too much money because it takes away when they are spending the money; it takes away the advantage, so there is a natural break on the expenditures of money if we do two things: One, involve the people in affected industries and affected activities to interact with us when these decisions are being made in a forum where we know we can trust the data base, and, second, if we keep track of what is happening.

I was amazed when I came down to Washington. I wanted to be here because I wanted to work with the Office of State Technical Services. I thought that was a great idea and had great potential to build our economy.

I found when I got here, no one had kept track of anything except how much money they had spent. No one had tried to find out what had come back, and by the time I got that information together, it was too late. A Congressman who had no love for the program managed to kill it, and it was the end of the whole affair, and it need not have died. Had we had that information, we would have been able to prove to everybody that this was a wise investment.

The generic technology is in the same category. I cannot give you an answer as to how much is the right amount, but I think I know the right process to begin. It does not cost much money to begin that process right now.

Mr. **Brown**. Mr. Walgren.

Mr. **Walgren**. No questions, Mr. Chairman.

Mr. **Brown**. Thank you for coming down this morning and helping us out in this regard. We will look forward to seeing more of you.

Our last witness this morning is George Meixel, chairman, board of directors, of the American National Metric Council, and he is accompanied by Mr. David Gorin, who is the president of the American National Metric Council.

Which one of you is president?

Dr. **Meixel**. I am the chairman of the board, Mr. Chairman.

Mr. **Brown**. We apologize, gentlemen, for the lengthy schedule this morning and appreciate your patience, and your testimony will be included in full in the record and given very high weight by this subcommittee, even if you abbreviate it.

STATEMENT OF GEORGE D. MEIXEL, CHAIRMAN, BOARD OF DIRECTORS, AMERICAN NATIONAL METRIC COUNCIL, BETHESDA, MD., ACCOMPANIED BY DAVID GORIN, PRESIDENT, AMERICAN NATIONAL METRIC COUNCIL

Dr. MEIXEL. I wanted to say first that this testimony has been prepared as a joint effort of the staff of the council and the executive committee of the ANMC.

The American National Metric Council is pleased to once again have this opportunity to share our views on metric transition with this committee. Since our last appearance before you in February, 1982, we have been adjusting to changes in the Federal structures that deal with metric matters, and we have just recently completed a reassessment of our role and our view of an appropriate role for the Government.

I have submitted, for the record, a separate report, which spells out our interpretation of the respective private and public sector metric roles. My purpose before you today, however, is to briefly underscore the need for cooperative public and private efforts in regard to metric transition.

Let me begin by emphasizing our belief that any real accomplishments in addressing metric issues will be achieved only through a partnership of effort by the private and public sectors. Our economy is too large and too complex, and the issue of the expansion of metric use is too intertwined with related issues such as international trade, productivity, and reindustrialization, to enable the subject to be the exclusive domain of either the public or private sector.

Metric efforts must be cooperative with both groups sharing responsibility for various tasks. It is this idea of "accomplishment through partnership" that is the theme of our forthcoming ninth annual conference, which is co-sponsored by the Department of Commerce with us, the conference signifies the recognition and need for a joint effort.

ANMC has identified seven areas where cooperative effort between Government and industry would be beneficial:

One, to provide assistance to the public with information and education;

Two, the creation of a receptive public climate requires joint effort between private and public sectors.

Three, development of national transition plans on a sector-by-sector basis can be assisted by Government while remaining predominantly a private sector activity;

Four, consultation with various special interests such as labor, small business, consumers, educators, and State and local government;

Five, consultation and cooperation with international bodies is best accomplished in joint activity;

Six, the coordination of efforts in general education; and

Seven, response to inquiries on the status of metric use and general metric questions.

While all seven areas are important to eventual progress in resolving the issues, we are particularly concerned with the need for activity designed to create a positive public attitude toward the metric system and the need to provide the public with information and education.

In our view, these activities are vital in assisting the country in making a reasonable decision on expanded metric use and in supporting the industries that have already made the decision to use metric measures. Without an educated and informed public, decisions will be made based on emotion and rhetoric rather than on understanding and factual information.

ANMC is prepared to share and cooperate in these seven tasks with the public sector and will apply a portion of its limited resources to doing so. We ask the Federal Government to do the same and to apply some of its resources to these joint activities.

ANMC is optimistic that the new Office of Metric Programs will provide the necessary coordination between Government interests and will provide appropriate support and assistance to the private sector in assuring that the Government is not a hindrance to private sector metric transition.

We hope that the Office will very shortly be completely staffed and that a permanent Director will be named as quickly as possible.

We understand that a long-range plan for the Office is under development; we would hope that private-sector consultation—with ANMC—about this plan will take place before it is completed and will continue through future refinements and modifications as circumstances require. We are sincere in our desire for a partnership arrangement and encourage the Government to join with us.

Finally, ANMC is concerned that the issues of metric transition have languished unaddressed too long. ANMC, on February 9, 1982, adopted a policy which states: "ANMC recognizes that the use of the International System of Units—SI—is increasing in the United States and that this trend is expected to continue until eventually SI is the predominant measurement system . . ."

A joint public and private effort is needed to establish a national program that is in concert with this belief. We urge the Congress to consider taking appropriate actions to clarify our Nation's metric policy and goals and to work with the private sector toward ending the seemingly endless debate. Sitting on the metric fence indefinitely is unproductive and costly.

Thank you.

[The prepared statement of Dr. Meixel and the "Report of the Ad Hoc Committee on the Changing Role of ANMC" follow:]

Remarks by George D. Meixel, Chairman, Board of Directors, American National Metric Council

My name is George Meixel and I am the Manager of the Washington Office of Ingersoll-Rand Company. It is also my pleasure to serve as the Chairman of the Board of Directors of the American National Metric Council, a position I have held since 1982. Ingersoll-Rand is a charter subscriber to ANMC.

With me is Mr. David Gorin, the President and Chief Executive Officer of the Council.

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Thank you.

Report of the Ad Hoc Committee on the Changing Role of ANMC

(Approved by the Board of Directors on February 23, 1983)

Statement of ANMC Policy

The United States' political, business, scientific, and engineering interests apparently recognize that the standard measurement system accepted throughout the world is SI. ANMC recognizes that the use of SI is increasing in the U.S. and that this trend is expected to continue until eventually SI is the predominant meassurement system.

I. The Role of the ANMC

1. To be the voice for the private sector in a rational metric transition
2. Provide leadership for coordinated national planning concerning metric transition
3. To provide a forum for industry-wide metric planning that minimizes antitrust implications
4. To provide a structure for metric planning including provision for
    - o An active planning posture
        - o Provide models - provide results, illustrated by models, evaluations and case histories of potential and actual economic, commercial, industrial and consumer benefits.
        - o Conduct planning through coordinating groups/sector committees/ advisory groups.
    - o Private sector planning procedures
    - o Review and endorsement of plans
    - o Identification of barriers
    - o Identification of standards requiring metrication, evaluation of priorities and recommendations for standards development
5. Provide information (metric news) to:
    - o Subscribers
    - o Government - federal, state, local
    - c Media
    - o Educational system - public, higher education, trade/vocational education
    - o Other nations
    - o Organizations - trade, professional, labor, consumers

    and to serve as an information collection agency.

6. Government representation

    - Represent/speak/be the voice of private sector to the government in transition planning

    - Provide periodic reports of private sector development, status, activity to members of government

7. Other Roles:

    - Provide services on a contract basis to government and private sector organizations

    - Provide review and recommendations on conformance to estabilished metric terminology and style in editorial matter and other forms of communication.

II. The Role of the Federal Government

1. Clarify understanding of U.S. metric policy as stated in the Metric Conversion Act of 1975.

2. Provide coordination between agencies on federal level, between states/states and federal and public and private (via ANMC) interests.

3. Research to establish areas/issues where initiatives are needed.

4. Support voluntary conversion activity.

5. Conduct a study to determine metric impact on trade, materials, and machinery in selected sectors - what is cost if we don't go metric?

6. Provide specific metric data needed by industry (collect, analyze and publish data.)

7. Recommend approaches for seeking removal of barriers.

8. Retain ICMP/MOC structure.

9. Provide assistance to and cooperate with private sector transition planning as requested.

10. Publicize proposed programs.

11. Encourage retention of U.S. practices accepted worldwide in metric terms.

12. Submit an annual report to Congress and the President.

III. Joint Roles of the Public and Private Sectors

1. Collaborate on the development of a national plans.
2. Consultation with various interests.
3. Consult and cooperate internationally.
4. Assist public with information and education.
5. Coordinate general education.
6. Create receptive public climate.
7. Respond to inquiries on metric and status of conversion.

Mr. BROWN. Thank you very much, Dr. Meixel. We appreciate that emphasis upon the need for cooperative partnership approach. I think that we perhaps have not given sufficient emphasis to that in the past, and it may be helpful in maintaining a strong Federal effort to realize that it takes two to have a partnership.

Did you have anything further to add, Mr. Gorin?

Mr. GORIN. No, not at this time, other than to reiterate our desire to work with the Federal Government and to resolve the issue one way or another in a reasonable period of time.

Dr. MEIXEL. There are two issues that we reflect here. One is, there is a public fear of the metric transition which is really not necessary.

The second one is that the Government moved ahead in the early seventies to go into it, and then it lost its steam, and so the public is quite confused, so when we say goals, we really mean it.

We think the Government collectively has confused the public. Put it out and discuss it and work it out. We don't want a mandated system, but we would sure like to know which way we are headed.

Mr. BROWN. Mr. Walgren.

Mr. WALGREN. What has happened in the last year and a half in this area? If we have a new Office of Metric Programs, and we don't quite have a director, they must have some staff. What has happened in the last year from your perspective?

Dr. MEIXEL. A number of people have left us. The ones that believe in this thing are going ahead with us. We are sort of marking time.

A lot of major firms have either gone metric or they are positioned to go metric.

Most leading industries and leading organizations, such as the leading colleges, are positioned.

Now, the public is confused.

Mr. GORIN. What is happening now is that the progress is slow and steady, but it is continuing. There is no doubt about it. It is not happening in a way that is smacking the consumer in the face, so, therefore, it is not attracting a whole lot of attention over these days.

The economy is a hindrance to anybody wanting to do anything, when they are worried about keeping their doors open. Companies have been very reluctant to undertake some of the short-term costs with going to more metric use. There are long-term benefits if they will bite the bullet and take those short-term steps at the time.

The No.1 companies in almost every industry you can name have ongoing metric programs, because they realize the inevitability of the whole situation.

Dr. MEIXEL. One of the things some of us have talked about is the need to clear up the confusion. The Commerce Department came out with a study in 1971 and said, let's go. GAO came out in a study in 1978 and said not necessarily.

The Metric Board has been done away with. That is a signal that there is no activity. Some people think that we are the national metric council. They said, "They did away with you, too." Well, they have not. We are still the group in place and doing it.

Commerce is marking time; watching what we are doing is the same thing.

Mr. GORIN. We are very hopeful that the full-time permanent director appointed at the Department of Commerce to head this office will be someone from the private sector who will help provide some leadership within the Department of Commerce, and not simply mark more time for us.

Dr. MEIXEL. I worked for a number of bosses that said, if you have a problem, and you want me to do something, what do you suggest we do?

And one of the things some of us have done is work up an idea for—and don't shudder—another study, but it is a little different. It would be done by a private organization, not the Government, with a protocol written in advance which would be hearings held on the protocol, and we would point it at what happens if you go metric in two areas.

What would happen to the machinery industry because that tends to be a multinational one that has quite a bit of requirement for metric fasteners as against industry fasteners, and what would happen in the materials area.

The reverse of that thing is, what if you don't go? What is going to happen to the American machinery industry if it does not start to push a little stronger?

Mr. WALGREN. How would we get in a position to do that kind of a study?

Dr. MEIXEL. I would suggest that you either ask it be funded under a Presidential thing or as a separate bill and have it worked on and done.

For instance, such a study was done in the Energy Act of 1978 on whether certain machinery, motors, and pumps should be mandated that so many of them should be made more efficient, or have efficiency labeling.

We participated in that thing, and initially were a little skeptical of it being useful, but by the time it was over with, we were impressed by all the information that was pulled together, and in one of the industries they said, yes, you should go ahead and label them and in the other ones you did not need to because they were accomplishing it. This was done by an outside organization that was in a position to do it and had private sector and Government participation, and it worked.

We can give you a draft of something we worked up over a year ago.

Mr. **Walgren**. I would certainly personally be interested.

Dr. **Meixel**. I will see that you get a copy.

Mr. **Walgren**. Thank you very much, Mr. Meixel.

Mr. **Brown**. Gentlemen, I do not think that I have any further questions. I appreciate your testimony very much, and we expect to be keeping in close touch with you.

The subcommittee will be adjourned until 1:30.

[Whereupon, at 12:30 p.m., the subcommittee adjourned, to reconvene at 1:30 p.m. this same day.]

AFTERNOON SESSION

Mr. **Brown**. The subcommittee will come to order.

This afternoon we continue with a series of hearings on the program of the National Bureau of Standards focusing on the Institute for Computer Sciences and Technology.

We have a distinguished panel of witnesses to start off this afternoon, and I am going to recognize the chairman of the full committee, Mr. Fuqua of Florida to introduce our first distinguished witness this afternoon.

Mr. **Fuqua**. I am very pleased to have a member, and a personal friend, a State Senator from Florida chairing the Joint Select Committee on Electronic Data Processing for the Florida Legislature here.

I might say, Speaker Carl Albert appointed a committee, an ad hoc committee, to look at information services for the Congress, and how we could upgrade our activities. Mr. Brown remembers, how we were very antiquated for many, many years.

One of the first places we went was to the Florida Legislature where I was aware of the modernization that they had had, particularly in data processing, and computer information, not only for bill drafting but for keeping up with it, and for reference information. You dial-in number and get the status of a bill, the entire works, and that has been very many years ago.

They have been a progressive leader in that. Senator George Stuart, chairman of the Joint Select Committee, has been one of the leaders of that in the Florida Legislature, and we in Congress and other places can probably cite that as one of the models.

I am sure there are other outstanding examples in the country, but Senator Stuart has been a leader, not only in the State Senate in Florida, but particularly in the field of electronic data processing, and I know the interest of Mr. Brown and members of our committee and the potential for this.

I am very pleased to welcome Senator Stuart and the other people who make up the panel including Dr. Henderson, who is on the staff of the Florida Legislature. So we are very pleased to have you here today, George, and I know your testimony will contribute a great deal to a better understanding of how we can follow the lead that the Florida Legislature has established in electronic data processing.

I am very pleased to welcome you here.

Mr. BROWN. Accompanying Senator Stuart is Dr. John Henderson, Staff Director. Also on the panel is Douglas Ross, Chairman of the National Academy of Sciences Evaluation Panel for ICST, and Mr. Blake Greenlee, Chairman of the Working Group on Financial Services of the American National Standards Institute.

I cannot think of a group better qualified to advise us on what to do with the Institute, so please proceed.

[A biographical sketch of Mr. Stuart and Mr. Henderson follows:]

Senator George Stuart, Jr.
Chairman
Joint Select Committee on
Electronic Data Processing
The Florida Legislature
Tallahassee, Florida

Senator George Stuart, Jr. (Democrat, Orlando) is Chairman of the Joint Select Committee on Electronic Data Processing in the Florida Legislature. He has served as a State Senator since 1978.

Before his election to the State Senate, he served as an Orlando City Commissioner and on the Florida State Resource Recovery Council. In addition to serving on the Florida Senate's Governmental Operations Committee and Chairing the Economic, Community and Consumer Affairs Committee, he is currently a member of the Southern Growth Policies Board.

Senator Stuart has received many honors and awards for public service including the Jaycees' Five Outstanding Men in Florida in 1979 and several Outstanding Legislator Awards.

Senator Stuart received a B. A. from the University of Florida and a Master's of Business Administration from Harvard University. He is Chairman of the Board of George Stuart, Inc., an office products retail firm in Orlando.

Dr. John C. Henderson
Staff Director
Joint Select Committee on Electronic
Data Processing
The Florida Legislature
Tallahassee, Florida

Dr. John C. Henderson is Staff Director for the Joint Select Committee on Electronic Data Processing, Florida Legislature. While serving in this capacity he is on leave of absence from Florida State University where he is an Associate Professor of Management and Director of the Center for Information Systems Research. Prior to joining the faculty at Florida State University, he served on the faculty at The Wharton School, University of Pennsylvania and on the faculty of the College of Business Administration at Ohio State University. Dr. Henderson's primary areas of teaching, research and consulting are in decision support systems design and implementation and in strategic planning.

STATEMENTS OF SENATOR GEORGE STUART, JR., FLORIDA STATE LEGISLATURE, CHAIRMAN, JOINT SELECT COMMITTEE ON ELECTRONIC DATA PROCESSING, ACCOMPANIED BY JOHN C. HENDERSON, STAFF DIRECTOR, JOINT SELECT COMMITTEE

Mr. STUART. I appreciate the very kind remarks from my second home. We start meeting in the first part of April and I have to move to your district for 2 to 3 months every year, and share him with his constituents up there.

The Florida Legislature established a Joint Committee on Electronic Data Processing about 2 years ago in response to a number of problems that we had seen developing.

I have expressed it to others, that we would have a computer blow up in our face from the legislative standpoint every year or two, and we formed this committee to try to work on setting State policy in the State government.

We used a task force approach and we got private industry to contribute top data processing consultants, and top data processing managers from the Florida fruit industry and organized them into five different task forces.

One of those task forces was in the field of telecommunications, as well as others in management, purchasing, and so on.

During that time, the task forces and our staff, Dr. Henderson and myself, visited the Institute for Computer Science and Technology, consulted with them, and were very impressed with what they told us as well as what they offered to the State of Florida in trying to set computer policy.

No single State could possibly afford the luxury of a standard-setting agency. It would be ludicrous that it would not even be an issue before any State legislature. If I, as a State legislature, suggested that we set some kind of computer standards in Florida, it would simply go nowhere.

No one would consider that Florida would have a comprehensive standard-setting operation, and then Rhode Island would have something else and California something else.

It just would not happen. We are dealing in two areas that are very important to Florida in the data processing policy. The first is in connecting computers to computers, the issue of networking systems, and the institute has done a great deal of work in that, and the second area that we find of interest is in what is called local area networks, in other words, within an agency, will their word processers and microcomputers and everything else within the agency hook up to the same system?

Our State from a policy standpoint, and I suspect all States, and I think the Federal Government would have the same interest, would need a consistent computer to computer link and they need consistent local area networks in order for us to then begin the process of purchasing equipment that is standard to these two networks so it is in this context that we went to the institute.

It is important that the work we did since we visited the institute was not only general in nature, the general discussion I am talking about, but we have specifically used the recommendations of the institute as we tried to set this State policy.

We will specifically require that our State agencies, some 25 of them, adopt the standards established by the institute, that the computers bought will have this institute standard.

I would further point out that when we made our trip to the institute, we took with us members of our task force, the two that happened to visit at that time was the head of telecommunications for Ryder Truck Systems in Miami, and the head of telecommunications for Eastern Airlines, both which have a large interest in telecommunications and connecting computers.

We have had discussions with them, and the feedback that they gave us and I can speak on their behalf in this regard is that they were very impressed with the quality of the staff and the work efforts going on.

This is coming from private industry now. They considered the institute an effective facilitator, that is, the institute, could get industry together on these standards.

As we left the meeting, one of these gentlemen, who is very important in this data processing area, said to Dr. Henderson that his visit to the institute was like him being a farmer and finding out that there is an effective agricultural extension agency in his county, that that was from his standpoint, somebody dealing in telecommunications that he found a very effective organization that would be very helpful to them.

If the institute is not in place, as I understand the proposal being made, that it would be very difficult to operate, from a policymaker's standpoint in Florida. Where would we turn for these standards?

We could not develop our own standards. Some have suggested, I suppose, that we could turn to the university system, and consult with one of our good universities in Congressman Fuqua's district, and to have some standard set by a university staff or faculty.

I think we can all see the problems in that kind of approach. Second, I suppose we could hire a consultant. That is very popular in Florida and I presume in Washington. That would cost us a lot of money, but we could do it on a consultant basis.

Probably what we would end up doing is adopting some vendor standard as our standard out of, more or less, desperation and not having another alternative.

When we adopted vendor standards, it seems to me from a policymaker's standpoint, we would be setting a policy that would not allow the widest competition in these areas of purchasing and hooking up these computers, so I don't see any other alternative other than to have an effective organization in the Federal Government that does this policymaking, or does this standard-setting.

We have submitted some additional remarks that are for the committee, but that is the gist of what our position would be.

Dr. Henderson is here with me. I stole him from Florida State University. He has been our staff director for 1½ years.

He is on leave from the College of Business at Florida State and is a known top-level expert. I have to give him compliments, because we don't pay him enough, in the area of management information systems, and he has been on our staff for this 1½-year project and is prepared to assist and answer questions of a technical nature.

[The prepared statement of Mr. Stuart follows:]

Statement of State Senator George Stuart, Jr.

I COME BEFORE YOU TODAY AS A STATE POLICY-MAKER WHO IS INVOLVED IN THE DEVELOPMENT OF INFORMATION TECHNOLOGY POLICY FOR THE STATE OF FLORIDA. I AM CURRENTLY THE CHAIRMAN OF THE JOINT SELECT COMMITTEE ON ELECTRONIC DATA PROCESSING FOR THE FLORIDA LEGISLATURE. THIS COMMITTEE WAS FORMED IN RESPONSE TO AN OVERWHELMING CONCERN BY FLORIDA POLICY-MAKERS THAT WE ARE DRIFTING AIMLESSLY IN OUR EFFORTS TO EFFECTIVELY MANAGE INFORMATION TECHNOLOGY. AS A RESULT, WE ARE EXPERIENCING AN ALL-TOO-FAMILIAR SERIES OF MISSED OPPORTUNITIES AND PUBLICLY EMBARRASSING "COMPUTER DISASTER" STORIES.

THIS COMMITTEE WAS ORGANIZED USING A TASK FORCE APPROACH THAT BROUGHT TOGETHER EXPERTS FROM THE PRIVATE SECTOR AND ACADEMIA TO STUDY FLORIDA'S INFORMATION TECHNOLOGY PROBLEMS. TASK FORCE GROUPS WERE FORMED IN THE AREAS OF MANAGEMENT, PURCHASING, HUMAN RESOURCES, TELECOMMUNICATIONS, AND SMALL SYSTEMS INTEGRATION. IT IS IN THE CONTEXT OF THESE LAST TWO TASK FORCE GROUPS THAT WE BECAME AWARE OF, AND ULTIMATELY UTILIZED, THE WORK OF THE INSTITUTE FOR COMPUTER SCIENCE AND TECHNOLOGY (ICST).

MEMBERS OF THESE TASK FORCE GROUPS VISITED ICST IN OCTOBER, 1982. THEY WERE PROVIDED WITH A SERIES OF BRIEFINGS ON CURRENT TECHNOLOGY AND OBTAINED A VARIETY OF ICST REPORTS. THIS INFORMATION WAS USED EXPLICITLY BY OUR TELECOMMUNICATIONS TASK FORCE FOR DEVELOPING POLICY RELATING TO WIDE-AREA

NETWORKS (I.E., STANDARDS FOR THE OPEN SYSTEMS INTERCONNECT MODEL) AND BY THE SMALL SYSTEMS INTEGRATION TASK FORCE FOR ITS WORK ON LOCAL-AREA NETWORKS. IT IS IMPORTANT TO NOTE THAT THE WORK OF ICST NOT ONLY PROVIDED A SPECIFIC BASIS FOR STATE-WIDE POLICY CONCERNING STANDARDS BUT ALSO ILLUSTRATED THE USE OF AN EFFECTIVE FRAMEWORK FOR PLANNING IN THESE AREAS. THE MANAGEMENT TASK FORCE NOTED THAT THE ABSENCE OF A COMMON PLANNING FRAMEWORK AMONG AGENCIES WAS A PRIMARY CAUSE OF FLORIDA'S INFORMATION MANAGEMENT PROBLEMS. HENCE, THE WORK OF ICST IN THE PLANNING AREA HAS BECOME A VALUABLE AID TO OUR EFFORTS!

ONE IMPORTANT ELEMENT IN OUR EFFORTS WAS TO OBTAIN OUR OWN TECHNICAL EXPERTISE. THOUGH WE RELIED HEAVILY ON NON-GOVERNMENTAL SOURCES FOR EXPERT ADVICE, THE EXISTENCE OF AN INTERNAL, UNBIASED EXPERT STAFF PROVED QUITE IMPORTANT. ICST PLAYS AN IMPORTANT ROLE IN THIS REGARD. THEY PROVIDE AN INDEPENDENT SOURCE OF EXPERTISE THAT CAN BE USED BY POLICY-MAKERS AT ALL LEVELS OF GOVERNMENT. WHILE PRIVATE-SECTOR INTERESTS CONTRIBUTE TO ANY FINAL DECISIONS CONCERNING APPROPRIATE STANDARDS, I THINK THE FEDERAL GOVERNMENT MUST EXERCISE LEADERSHIP IN THIS EFFORT. THE FEEDBACK FROM MY STAFF AND TASK FORCE MEMBERS IS THAT THE TRACK RECORD FOR ICST IN THIS REGARD IS EXCELLENT.

SETTING STANDARDS IN SUCH A DYNAMIC FIELD AS COMPUTER TECHNOLOGY IS A DIFFICULT CHALLENGE. HOWEVER, THE BENEFITS ARE QUITE SIGNIFICANT. THESE STANDARDIZATION EFFORTS WILL PROMOTE A COMPETITIVE INFORMATION TECHNOLOGY MARKET AND THEREBY INCREASE INNOVATION AND PERMIT MARKET FORCES TO ESTABLISH PRICES. THIS LATTER FEATURE IS VERY IMPORTANT IN THAT IT ALLOWS STATES TO CONTINUE THE USE OF COMPETITIVE ACQUISITION STRATEGIES TO ENSURE REASONABLE PRICES.

I SHOULD NOTE THAT MY CONCERN FOR INFORMATION TECHNOLOGY POLICY IS NOT LIMITED TO SYSTEMS THAT AFFECT ONLY AGENCIES WITHIN FLORIDA. THERE IS A GROWING INTERCHANGE OF INFORMATION BETWEEN FEDERAL AND STATE AGENCIES. CLEARLY, WE NEED TO ESTABLISH A BASIS FOR COMPUTER-TO-COMPUTER EXCHANGE OF THIS INFORMATION. WITHOUT THE STANDARDS WORK OF ICST, I FEAR SUCH CAPABILITY WILL BE LONG IN COMING AND INORDINATELY EXPENSIVE.

JUST AS IT IS IMPORTANT TO COORDINATE FEDERAL AND STATE POLICIES, WE MUST ALSO WORK TO ACHIEVE COMPATIBILITY AT AN INTERNATIONAL LEVEL. ICST PROVIDES EFFECTIVE U. S. REPRESENTATION IN THE ONGOING EFFORTS TO AGREE ON IMPORTANT INTERNATIONAL COMPUTER STANDARDS.

I BELIEVE ICST HAS BEEN AN AGGRESSIVE, INNOVATIVE FORCE IN THIS COMPLEX ARENA OF HIGH-TECHNOLOGY POLICY. THE EFFORT TO

DISSEMINATE THE RESULTS OF THEIR WORK IS IMPRESSIVE. FOR EXAMPLE, THEIR USE OF CONFERENCING TO SUPPORT STATE AND LOCAL GOVERNMENT PLANNING EFFORTS HAS BEEN WELL RECEIVED IN FLORIDA.

WITHOUT A DOUBT, HIGH TECHNOLOGY WILL BE A KEY TO INCREASED PRODUCTIVITY IN THE PUBLIC SECTOR. I THINK WE SHOULD BE INVESTING MORE, NOT LESS, IN INDEPENDENT, UNBIASED TECHNOLOGICAL EXPERTISE. IN MY VIEW, IT IS THE ONLY WAY TO MAKE SIGNIFICANT PROGRESS IN POLICY DEVELOPMENT WHILE ENSURING EQUAL ACCESS FOR THE VARIETY OF EFFECTED INTERESTS.

THANK YOU FOR THE OPPORTUNITY TO APPEAR BEFORE YOU. I HOPE I HAVE HELPED TO CLARIFY THE IMPORTANCE OF ICST AND THE NEED FOR YOUR CONTINUED SUPPORT.

Mr. Brown. Thank you very much. I hope this will be an encouragement to get more State legislatures to come down and look at your institute.

Mr. Fuqua. As I understand it, what the Commerce Department is proposing to transfer ICST from the Bureau of Standards, while probably still physically located there, but for budget and management reasons, it would be transferred to an Office of Telecommunications that is housed within the Department of Commerce.

Do you think that would hamper the ability for the standards to be established?

It would still be operating and its home base would be transferred, as far as budget and management is concerned, from the Bureau of Standards also under the Department of Commerce, to another part of the Department?

Mr. Stuart. I am really not the one to answer that question. I think some of the other speakers can speak more about that issue.

Mr. Fuqua. Your major concern is that this type of service continues to be available?

Mr. Stuart. Right, and if it is not available, it will hamper our efforts. You made a comment to Mr. Brown about whether we are a little bit ahead of the rest of the States. I don't know that we are.

Some other States have done some of the work that we are doing, but there are not many of the States that do and we need special attention in this area.

Data processing is a $150-million-a-year issue now in our budget and growing at a rate of 20 to 30 percent a year. In Florida's budget that means by the end of the eighties, it would be a balanced issue in our budget and the other States, that are of our size and larger. It is equal to more and that is a lot of stuff we will be buying and renting and we will have to have——

Mr. Fuqua. We were just under—our total State budget was just under $1 billion?

Mr. Stuart. We are over 10½ billion now and as we all recognize, our budget totally will not grow in amounts anything like 20 or 30 percent, but if the information segment is growing 20 to 30 percent, which is what I am told is very possible, it will begin to be a larger part.

Government is information. We are in the information business. Occasionally we do build a road and once in a while we catch a criminal, but other than the few times, the 100,000 State employees that work for the State are in the business of gathering and disseminating and teaching information, and these tools, productivity tools, that are available from computers, are where we are going to make our greatest gains, in education, particularly.

Mr. Fuqua. Right. That was all I had, Mr. Brown.

Mr. Brown. Senator, can you remain a little bit longer?

I would like to have the other witnesses on the panel present their statement and then have a little discussion after we get through.

Mr. Stuart. Sure.

Mr. Brown. All right, Mr. Greenlee, would you care to go next on this show.

[The biographical sketch of Mr. Greenlee follows:]

Blake Greenlee is a Vice President in the International Technology group at Citibank, and Assistant Minister, St. Stephen's Church, Ridgefield, Connecticut. At Citibank, he is responsible for authentication and key distribution for the bank's worldwide funds transfer network, chairs ANSI working groups on authentication and key management, and is a U.S. technical expert on these subjects on ISO working groups. Previous assignments at Citibank include development of long range plans for distributed processing; development of corporate standards for Operations Risk Assessment and Protection of Telecommunications; responsibility for the privacy law/transborder information flow issue and for audit software.

Prior to joining Citibank, Blake was Technical Director of TTI (East) - a subsidiary of Citibank, with MITRE where he served as a consultant to JCS, USIA and the IRS, and John Hopkins Applied Physics Lab where as Program Manager he had responsibility for a variety of programs including the Polaris satellite navigation system and the production procurement of Navy Navigation Satellites.

Blake has a B.S. in Physics and Mathematics from Purdue, has done advanced work in physics at Purdue and the University of Maryland, received his MBA from George Washington University and completed a three year program at the General Theological Seminary.

STATEMENT OF M. BLAKE GREENLEE, CHAIRMAN, WORKING GROUP ON FINANCIAL SERVICES, AMERICAN NATIONAL STANDARDS INSTITUTE

Mr. GREENLEE. My name is Blake Greenlee, and although I am a City Bank employee, I am here as the chairman of two working groups of the American National Standards Committee on Financial Services. These working groups have been and are developing national standards for authenticating financial messages such as funds transfers and for the interchange and management of cryptographic keys.

I am also a designated U.S. technical representative to the working group of International Standards Organization that is developing similar standards.

As background, the Financial Services Committee of ANSI is a private sector organization that develops, on a consensus basis, standards that are needed for all types of financial institutions—including banks, savings institutions, credit unions and the securities industry.

Within the parent committee, working groups are formed to develop individual standards as needs arise. Members of the working groups, while employed by financial institutions, vendors, or consulting organizations, represent only themselves on such a working group and are tasked with developing uniform solutions to problems that range from printing standards for check encoding to securing Electronic Funds Transfer Systems against fraud both for wholesale customers, e.g., banks, corporations, and retail customers, e.g., individuals.

Draft standards produced by a working group go through a series of formal public reviews and ballots. After all questions have been formally answered in writing, and a careful review has been made to assure that the resulting document is indeed a product of a consensus process, it is issued as an American national standard.

There are many ANSI committees and working groups, as well as affiliated organizations. There are ANSI standards that affect the production of most of the things that we use in our lives.

Things like screws, pipes, electrical equipment, building construction practices, as well as more esoteric things like computer languages, telecommunications techniques, and cryptography.

The driving force in producing a new standard is either a present or a foreseen need for product compatibility, safety, interchangeability, et cetera. In the case of the two working groups that I chair, the effort addresses the need to provide for growth in the security of financial institutions' telecommunications that matches the rapid changes in that technology and its usage in our industry.

The growth and strength of American industry has in large measure been dependent on the availability of standards. A bolt made in Ohio will fit in a machine, or car, made in any other State.

A two-by-four sawed and planed in Oregon when delivered to a builder in Virginia will fit, and can plan the building design around that.

An entrepreneur in California can start a new business, thus creating jobs, secure in the knowledge that the parts that are made can be sold and installed throughout the United States and the world.

Consumers have the freedom to pick from a variety of parts suppliers when fixing the family car, or to buy electrical appliances safe in the knowledge that they will operate anywhere in our country.

Underlying this is a framework of national standards of length, time, temperature—the physical measurements system that is a requirement for the operation and the expansion of U.S. industries.

Without these standards and the private sector standards that have been issued, our homes, our jobs, the conveniences that we use and our health care would be much different.

I believe that our industrial mix is changing. Whether from reading books like Toffler's "New Wave" or from observing the advertisements for personal computers and highly automated banking services on television, the only conclusion that can be reached is that we are in a state of change whose rate greatly exceeds that of the industrial revolution.

The information industry, born in laboratories like the NBS, is producing new jobs, new opportunities and new ways in which businesses and individuals work, communicate and play.

But we are not alone in this information revolution. The competition from foreign companies in the semiconductor, computer, telecommunications, and automation fields is based on a technology almost as strong as ours.

Jobs and industries are at stake. Competition was a tonic and driving force for the growth of our automobile and machine tool industries earlier in this century. National and private sector standards underpinned that growth. Our information industry's growth in today's highly competitive environment also depends on private sector standards backed by a strong technological base, including good national standards.

The standard meter, second, and degree are and will continue to be important. But if we are to maintain the growth of our information industry, we must also have standards in areas such as data interchange, telecommunications, security, and programing and control languages.

And, to support such developments, there must be a change in the focus of the National Bureau of Standards. An organization that has built a reputation second to none in the support—through standardization—of manufacturing industries, must realine its efforts to provide support for the information and service industries that is comparable to the present and pending importance of these industries to our national growth.

Let me give you a specific and timely example. In developing new standards to protect high dollar value electronic funds transfers from fraud, we have developed, with the active participation of staff at the Institute for Computer Sciences and Technology, a new technique called Financial Institution Message Authentication.

I have a couple of copies of the standard here for the committee.

Specifically, the Institute for Computer Sciences and Technology programed and tested the technique proposed for the Financial Institution Message Authentication Standard to assure that the process was adequate and complete.

The Institute provided a test message with expected results as a standard tool for vendors.

In trying to get this technique adopted as an international standard, we have progressed to the point of a first draft in the International Standards Organization.

But two alternative authentication computation procedures, called algorithms, have been proposed by foreign representatives to the ISO committee. These algorithms have been proposed as substitutes for our NBS Data Encryption Algorithm, called DES, which the private sector calls DEA.

Frankly, it is beyond the capability of private industry to evaluate cryptographic algorithms. I have submitted copies of these proposals to the NBS, but they are not presently staffed to perform this evaluation in support of our working groups.

A computation procedure seems like a small matter. Yet, if these algorithms are not as secure as the DES, then financial transactions—that have an average value of $2 million—and the privacy of individual and corporate telecommunications entrusted to them may be secure, or secure enough.

We, on the working group, think that the DES is better. But we cannot go into an international standards arena—where decisions are made by consensus—and state that it is the best way to go, without some proof.

In the case of the key management standard that is currently under development, we are planning to work with the Institute over the next 12 to 18 months.

I expect that other private sector standards for the financial services industry requiring the underpinning of Federal standards and standards efforts will follow. Let me give you two examples.

When we think of communications within a large building, a geographic area, a business or a school, we think of telephones and intercoms. But telecommunications technology is providing new tools such as local area networks—with computer-like services replacing or augmenting simple voice communications.

Electronic mail, voice mailboxes, teleconferencing via satellite, decentralization of work input—Toffler calls it the "electronic cottage"—and computer aided instruction for schoolchildren are but a few examples.

For these services—and the jobs that depend on them—to grow, there must be standards for how they talk to each other. There must be provisions made for security and privacy.

Without the hierarchy of industry standards based on a strong national standards effort, growth will be frustrated. I keep going back to the analogy of the family car. I have to repair one on a weekend. It would be like going to the store to buy a quarter to a 20 inch bolt and coming home and finding out it won't fit.

That bolt would cost me 50 cents, but when I design a network and communicate with another one, millions of dollars are involved in the development.

As the telecommunications and services industries grow, the importance of software engineering increases. We need improved methods for building programs for these systems and protecting them from accidental or deliberate change or misuse.

Again, standards—techniques, processes and interfaces for compatibility are required. With computer-driven machinery, safety is also an issue here.

I now would like to add a thought, speaking as a private individual involved in mission work to people in an inner-city environment. The growth of local area networks supporting computer-aided instruction is a potentially powerful tool for retraining educable workers that have been laid off for entirely new types of work.

Learning can be self-paced. At the present time, a wide variety of academic courses are available—like those that our children use in school. Programed instruction courses could be designed, implemented and made available through local area networks.

Variations using this technology include providing the capability for working mothers who now use terminal-oriented systems to work at home.

I guess I have to admit there is some resistance toward this from some conventional managers, but it is doable, and my written remarks say it is doable right now.

You do have to have standards for interoperability of systems, systems security and productivity measurement would, however, be necessary.

In closing, I would like to recommend that the support given to the Institute for Computer Sciences and Technology relative to the total support given to the NBS, both now and in the future be in proportion to the present and expected rate of growth of the information services and telecommunications industries when compared to other industries, for example, manufacturing.

Thank you very much for allowing me to speak on this important subject.

[The prepared statment of Mr. Greenlee follows:]

TESTIMONY OF M. BLAKE GREENLEE

MARCH 23, 1983

MY NAME IS M. BLAKE GREENLEE. I AM EMPLOYED BY CITIBANK, BUT I AM HERE AS THE CHAIRMAN OF TWO WORKING GROUPS OF THE AMERICAN NATIONAL STANDARDS COMMITTEE ON FINANCIAL SERVICES (ANSI, X9). THESE WORKING GROUPS HAVE BEEN AND ARE DEVELOPING NATIONAL STANDARDS FOR AUTHENTICATING FINANCIAL MESSAGES SUCH AS FUNDS TRANSFERS AND FOR THE INTERCHANGE AND MANAGEMENT OF CRYPTOGRAPHIC KEYS. I AM ALSO A DESIGNATED U.S. TECHNICAL REPRESENTATIVE TO A WORKING GROUP OF THE INTERNATIONAL STANDARDS ORGANIZATION (ISO) THAT IS DEVELOPING SIMILAR STANDARDS.

AS BACKGROUND, THE FINANCIAL SERVICES COMMITTEE OF ANSI IS A PRIVATE SECTOR ORGANIZATION THAT DEVELOPS, ON A CONSENSUS BASIS, STANDARDS THAT ARE NEEDED FOR ALL TYPES OF FINANCIAL INSTITUTIONS--INCLUDING BANKS, SAVINGS INSTITUTIONS, CREDIT UNIONS AND THE SECURITIES INDUSTRY.

WITHIN THE PARENT COMMITTEE, WORKING GROUPS ARE FORMED TO DEVELOP INDIVIDUAL STANDARDS AS NEEDS ARISE. MEMBERS OF THE WORKING GROUPS, WHILE EMPLOYED BY FINANCIAL INSTITUTIONS, VENDORS, OR CONSULTING ORGANIZATIONS, REPRESENT ONLY THEMSELVES ON SUCH A WORKING GROUP AND ARE TASKED WITH DEVELOPING UNIFORM SOLUTIONS TO PROBLEMS THAT RANGE FROM PRINTING STANDARDS FOR CHECK ENCODING TO SECURING ELECTRONIC FUNDS TRANSFER SYSTEMS AGAINST FRAUD BOTH FOR WHOLESALE CUSTOMERS (E.G., BANKS, CORPORATIONS) AND RETAIL CUSTOMERS (E.G., INDIVIDUALS).

DRAFT STANDARDS PRODUCED BY A WORKING GROUP GO THROUGH A SERIES OF FORMAL PUBLIC REVIEWS AND BALLOTS. AFTER ALL QUESTIONS HAVE BEEN FORMALLY ANSWERED IN WRITING, AND A CAREFUL REVIEW HAS BEEN MADE TO ASSURE THAT THE RESULTING DOCUMENT IS INDEED A PRODUCT OF A CONSENSUS PROCESS, IT IS ISSUED AS AN AMERICAN NATIONAL STANDARD.

THERE ARE MANY ANSI COMMITTEES AND WORKING GROUPS--AS WELL AS AFFILIATED ORGANIZATIONS. THERE ARE ANSI STANDARDS THAT AFFECT THE PRODUCTION OF MOST OF THE THINGS THAT WE USE IN OUR LIVES. THINGS LIKE SCREWS, PIPES, ELECTRICAL EQUIPMENT, BUILDING CONSTRUCTION PRACTICES, AS WELL AS MORE ESOTERIC THINGS LIKE COMPUTER LANGUAGES, TELECOMMUNICATIONS TECHNIQUES, AND CRYPTOGRAPHY.

THE DRIVING FORCE IN PRODUCING A NEW STANDARD IS EITHER A PRESENT OR A FORESEEN NEED FOR PRODUCT COMPATIBILITY, SAFETY, INTERCHANGEABILITY, ETC. IN THE CASE OF THE TWO WORKING GROUPS THAT I CHAIR, THE EFFORT ADDRESSES THE NEED TO PROVIDE FOR GROWTH IN THE SECURITY OF FINANCIAL INSTITUTIONS' TELECOMMUNICATIONS THAT MATCHES THE RAPID CHANGES IN THAT TECHNOLOGY AND ITS USAGE IN OUR INDUSTRY.

THE GROWTH AND STRENGTH OF AMERICAN INDUSTRY HAS IN LARGE MEASURE BEEN DEPENDENT ON THE AVAILABILITY OF STANDARDS. A BOLT MADE IN OHIO WILL FIT IN A MACHINE--OR CAR--MADE IN ANY OTHER STATE. A "TWO-BY-FOUR" SAWED AND PLANED IN OREGON, WHEN DELIVERED TO A BUILDER IN VIRGINIA, WILL FIT. AN ENTREPRENEUR IN CALIFORNIA, CAN START A NEW BUSINESS--THUS CREATING JOBS--SECURE IN THE KNOWLEDGE THAT THE PARTS THAT ARE MADE CAN BE SOLD AND INSTALLED THROUGHOUT THE U.S. AND THE WORLD.

CONSUMERS HAVE THE FREEDOM TO PICK FROM A VARIETY OF PARTS SUPPLIERS WHEN FIXING THE FAMILY CAR, OR TO BUY ELECTRICAL APPLIANCES SAFE IN THE KNOWLEDGE THAT THEY WILL OPERATE ANYWHERE IN OUR COUNTRY.

UNDERLYING THIS IS A FRAMEWORK OF NATIONAL STANDARDS OF LENGTH, TIME, TEMPERATURE--THE PHYSICAL MEASUREMENTS SYSTEM THAT IS A REQUIREMENT FOR THE OPERATION AND THE EXPANSION OF U.S. INDUSTRIES. WITHOUT THESE STANDARDS AND THE PRIVATE SECTOR STANDARDS THAT HAVE BEEN ISSUED, OUR HOMES, OUR JOBS, THE CONVENIENCES THAT WE USE AND OUR HEALTH CARE WOULD BE MUCH DIFFERENT.

OUR INDUSTRIAL MIX IS CHANGING. WHETHER FROM READING BOOKS LIKE TOFFLER'S "NEW WAVE," OR FROM OBSERVING THE ADVERTISEMENTS FOR PERSONAL COMPUTERS AND HIGHLY AUTOMATED BANKING SERVICES ON TELEVISION, THE ONLY CONCLUSION THAT CAN BE REACHED IS THAT WE ARE IN A STATE OF CHANGE WHOSE RATE GREATLY EXCEEDS THAT OF THE INDUSTRIAL REVOLUTION. THE INFORMATION INDUSTRY, BORN IN LABORATORIES LIKE THE NBS, IS PRODUCING NEW JOBS, NEW OPPORTUNITIES AND NEW WAYS IN WHICH BUSINESSES AND INDIVIDUALS WORK, COMMUNICATE AND PLAY.

BUT WE ARE NOT ALONE IN THIS INFORMATION REVOLUTION. THE COMPETITION FROM FOREIGN COMPANIES IN THE SEMICONDUCTOR, COMPUTER, TELECOMMUNICATIONS AND AUTOMATION FIELDS IS BASED ON A TECHNOLOGY ALMOST AS STRONG AS OURS. JOBS AND INDUSTRIES ARE AT STAKE. COMPETITION WAS A TONIC AND DRIVING FORCE FOR THE GROWTH OF OUR AUTOMOBILE AND MACHINE TOOL INDUSTRIES EARLIER IN THIS CENTURY. NATIONAL AND PRIVATE SECTOR STANDARDS UNDERPINNED THAT GROWTH. OUR INFORMATION INDUSTRY'S GROWTH IN TODAY'S HIGHLY COMPETETIVE ENVIRONMENT ALSO DEPENDS ON PRIVATE SECTOR STANDARDS BACKED BY A STRONG TECHNOLOGICAL BASE, INCLUDING NATIONAL STANDARDS.

THE STANDARD METER, SECOND, AND DEGREE ARE AND WILL CONTINUE TO BE IMPORTANT. BUT IF WE ARE TO MAINTAIN THE GROWTH OF OUR INFORMATION INDUSTRY, WE MUST ALSO HAVE STANDARDS IN AREAS SUCH AS DATA INTERCHANGE, TELECOMMUNICATIONS, SECURITY, AND PROGRAMMING AND CONTROL LANGUAGES.

AND, TO SUPPORT SUCH DEVELOPMENTS, THERE MUST BE A CHANGE IN THE FOCUS OF THE NATIONAL BUREAU OF STANDARDS. AN ORGANIZATION THAT HAS BUILT A REPUTATION SECOND TO NONE IN THE SUPPORT--THROUGH STANDARDIZATION-- OF MANUFACTURING INDUSTRIES, MUST RE-ALIGN ITS EFFORTS TO PROVIDE SUPPORT FOR THE INFORMATION AND SERVICE INDUSTRIES THAT IS COMPARABLE TO THE PRESENT AND PENDING IMPORTANCE OF THESE INDUSTRIES TO OUR NATIONAL GROWTH.

LET ME GIVE YOU A SPECIFIC AND TIMELY EXAMPLE. IN DEVELOPING NEW STANDARDS TO PROTECT HIGH DOLLAR VALUE ELECTRONIC FUNDS TRANSFERS FROM FRAUD, WE HAVE DEVELOPED, WITH THE ACTIVE PARTICIPATION OF STAFF AT THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY, A NEW TECHNIQUE CALLED FINANCIAL INSTITUTION MESSAGE AUTHENTICATION (AND I HAVE A COPY FOR THE COMMITTEE).

SPECIFICALLY, THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY PROGRAMMED AND TESTED THE TECHNIQUE PROPOSED FOR THE FINANCIAL INSTITUTION MESSAGE AUTHENTICATION STANDARD TO ASSURE THAT THE PROCESS WAS ADEQUATE AND COMPLETE. THE INSTITUTE PROVIDED A TEST MESSAGE WITH EXPECTED RESULTS AS A STANDARD TOOL FOR VENDORS.

IN TRYING TO GET THIS TECHNIQUE ADOPTED AS AN INTERNATIONAL STANDARD, WE HAVE PROGRESSED TO THE POINT OF A FIRST DRAFT. BUT, TWO ALTERNATIVE AUTHENTICATION COMPUTATION PROCEDURES, CALLED, "ALGORITHMS," HAVE BEEN PROPOSED BY FOREIGN REPRESENTATIVES TO THE ISO COMMITTEE. THESE ALGORITHMS HAVE BEEN PROPOSED AS SUBSTITUTES FOR OUR NBS DATA ENCRYPTION ALGORITHM (CALLED DES).

FRANKLY, IT IS BEYOND THE CAPABILITY OF PRIVATE INDUSTRY TO EVALUATE CRYPTOGRAPHIC ALGORITHMS. I HAVE SUBMITTED COPIES OF THESE PROPOSALS TO THE NBS, BUT, THEY ARE NOT PRESENTLY STAFFED TO PERFORM THIS EVALUATION IN SUPPORT OF OUR WORKING GROUPS.

A COMPUTATION PROCEDURE SEEMS LIKE A SMALL MATTER. YET, IF THESE ALGORITHMS ARE NOT AS SECURE AS THE DES, THEN FINANCIAL TRANSACTIONS (THAT HAVE AN AVERAGE VALUE OF $2,000,000) AND THE PRIVACY OF INDIVIDUAL AND CORPORATE TELECOMMUNICATIONS ENTRUSTED TO THEM MAY NOT BE SECURE--OR SECURE ENOUGH.

WE THINK THAT THE DES IS BETTER. BUT WE CANNOT GO INTO AN INTERNATIONAL STANDARDS ARENA--WHERE DECISIONS ARE MADE BY CONSENSUS--AND STATE THAT IT IS THE BEST WAY TO GO, WITHOUT PROOF.

IN THE CASE OF THE KEY MANAGEMENT STANDARD THAT IS CURRENTLY UNDER DEVELOPMENT, WE ARE PLANNING TO WORK WITH THE INSTITUTE OVER THE NEXT 12-18 MONTHS. I EXPECT THAT OTHER PRIVATE SECTOR STANDARDS FOR THE FINANCIAL SERVICES INDUSTRY REQUIRING THE UNDERPINNING OF FEDERAL STANDARDS AND STANDARDS EFFORTS WILL FOLLOW. LET ME GIVE YOU TWO EXAMPLES.

WHEN WE THINK OF COMMUNICATIONS WITHIN A LARGE BUILDING, A GEOGRAPHIC AREA, A BUSINESS OR A SCHOOL, WE THINK OF TELEPHONES AND INTERCOMS. BUT TELECOMMUNICATIONS TECHNOLOGY IS PROVIDING NEW TOOLS SUCH AS LOCAL AREA NETWORKS--WITH COMPUTER-LIKE SERVICES REPLACING OR AUGMENTING SIMPLE VOICE COMMUNICATIONS. ELECTRONIC MAIL, VOICE MAILBOXES, TELECONFERENCING VIA SATELLITE, DECENTRALIZATION OF WORK INPUT (TOFFLER CALLS IT THE "ELECTRONIC COTTAGE"), AND COMPUTER AIDED INSTRUCTION FOR SCHOOLCHILDREN ARE BUT A FEW EXAMPLES.

FOR THESE SERVICES (AND THE JOBS THAT DEPEND ON THEM) TO GROW, THERE MUST BE STANDARDS FOR HOW THEY "TALK" TO EACH OTHER. THERE MUST BE PROVISIONS MADE FOR SECURITY AND PRIVACY. WITHOUT THE HIERARCHY OF INDUSTRY STANDARDS BASED ON A STRONG NATIONAL STANDARDS EFFORT, GROWTH WILL BE FRUSTRATED. IT WOULD BE LIKE GOING TO THE HARDWARE STORE TO BUY A 1/4" X 20 THREADS PER INCH BOLT TO FIX YOUR CAR AND RETURNING HOME TO FIND THAT IT DIDN'T FIT. IT CAN ALSO BE COSTLY. A BOLT THAT IS DISCARDED BECAUSE IT DOESN'T FIT RESULTS IN AN OUT OF POCKET EXPENSE OF, PERHAPS, FIFTY CENTS. MILLIONS ARE SPENT DEVELOPING NETWORKS.

AS THE TELECOMMUNICATIONS AND SERVICES INDUSTRIES GROW, THE IMPORTANCE OF SOFTWARE ENGINEERING INCREASES. WE NEED IMPROVED METHODS FOR BUILDING PROGRAMS FOR THESE SYSTEMS AND PROTECTING THEM FROM ACCIDENTAL OR DELIBERATE CHANGE OR MISUSE. AGAIN, STANDARDS--TECHNIQUES, PROCESSES AND INTERFACES FOR COMPATIBILITY ARE REQUIRED. WITH COMPUTER DRIVEN MACHINERY, SAFETY IS ALSO AN ISSUE, HERE.

I NOW WOULD LIKE TO ADD A THOUGHT, SPEAKING AS A PRIVATE INDIVIDUAL INVOLVED IN MISSION WORK TO PEOPLE IN AN INNER CITY ENVIRONMENT. THE GROWTH OF LOCAL AREA NETWORKS SUPPORTING COMPUTER-AIDED INSTRUCTION IS A POTENTIALLY POWERFUL TOOL FOR RE-TRAINING EDUCABLE WORKERS THAT HAVE BEEN LAID OFF--FOR ENTIRELY NEW TYPES OF WORK.

LEARNING CAN BE SELF-PACED. AT THE PRESENT TIME, A WIDE VARIETY OF ACADEMIC COURSES ARE AVAILABLE (LIKE THOSE THAT OUR CHILDREN USE IN SCHOOL). PROGRAMMED INSTRUCTION COURSES COULD BE DESIGNED, IMPLEMENTED AND MADE AVAILABLE THROUGH LOCAL AREA NETWORKS.

VARIATIONS USING THIS TECHNOLOGY INCLUDE PROVIDING THE CAPABILITY FOR WORKING MOTHERS WHO NOW USE TERMINAL-ORIENTED SYSTEMS TO WORK AT HOME. THERE IS RESISTANCE TO BE OVERCOME FROM TRADITIONAL MANAGERS, BUT IT IS DO-ABLE, IN THE NEAR FUTURE. STANDARDS FOR INTEROPERABILITY OF SYSTEMS, SYSTEMS SECURITY AND PRODUCTIVITY MEASUREMENT WOULD, HOWEVER, BE NECESSARY.

IN CLOSING, I WOULD LIKE TO RECOMMEND THAT THE SUPPORT GIVEN TO THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY RELATIVE TO THE TOTAL SUPPORT GIVEN TO THE NBS, BOTH NOW AND IN THE FUTURE BE IN PROPORTION TO THE PRESENT AND EXPECTED RATE OF GROWTH OF THE INFORMATION SERVICES AND TELECOMMUNICATIONS INDUSTRIES WHEN COMPARED TO OTHER INDUSTRIES (E.G., MANUFACTURING).

THANK YOU VERY MUCH FOR ALLOWING ME TO SPEAK ON THIS IMPORTANT SUBJECT.

0520G

Mr. **Brown**. Thank you, Mr. Greenlee.

Can I ask Mr. Ross to proceed now?

[A biographical sketch of Mr. Ross follows:]

SOFTECH

DOUGLAS T. ROSS

Chairman, SofTech, Inc.

Douglas T. Ross received the degree of AB Cum Laude in Mathematics from Oberlin College in 1951, and the SM degree without course specification from M. I. T. in 1954. He completed the course requirements for the degree of Ph.D. in Mathematics at M. I. T. in 1956.

From 1951 to 1952 he was teaching assistant in the Mathematics Department at M. I. T., and the summer of 1952 was on the Research Staff of the Electronics Systems Laboratory, M. I. T. until the founding of SofTech in the summer of 1969. Since 1956 he was Head of the Computer Applications Group at the Laboratory, Lecturer in the Electrical Engineering Department, and Project Engineer for the M. I. T. Computer-Aided Design Project.

Broad fields of technical activity:

1952-1954	Generalized programs for autocorrelation and Fourier transform.
1953-1957	Large-scale data reduction using on-line manual intervention.
1954-1955	MIT Symposia on Fire-Control System Evaluation. First use of on-line interactive graphics including free-hand graphical input.
1955-1959	Directed development of integrated system of program-development, integration, and testing tools for production of large-scale military programs.
1956 and 1957	Taught sampling and quantizing theory in MIT Summer Course.
1957	Taught in Special Course on Programming of Numerically Controlled Machine Tools.
1956-1959	Created and directed development of APT System for automatic programming of numerically controlled machine tools, now an international standard.
1957-1960	Organized APT Project with Aerospace Industries Association and served as first Director.
1959-1969	Leader of MIT Computer-Aided Design Project including research and development in language theory, language design, generalized compiler construction, computer graphics hardware and software, and design applications.

1960-1962	Created Plex Theory of problem modeling and Algorithmic Theory of language.
1962-1969	Directed and led AED (Automated Engineering Design) Language and Compiler Development.
1964-1969	AED Cooperative Program of the MIT Computer-Aided Design Project Combined Visiting Staff from industry with MIT staff for AED research.
1968	Created and presented first Software Engineering graduate course at MIT.
1973-present	Originated Structured Analysis, embodied in SofTech's Structured Analysis and Design Technique (SADT^{tm}).
1974 and 1977	SofTech Principal Investigator for Air Force AFCAM and ICAM Projects.
1977	Originated Theory of Characterization, basis for ICODE Group Technology in manufacturing.
1969-1975	President, SofTech, Inc.
1975-present	Chairman of the Board of Directors, SofTech, Inc.
1979-1981	Chairman of the Board, SofTech Microsystems, Inc., 9494 Black Mountain Road, San Diego, CA 92126
1983-Present	Lecturer, MIT Electrical Engineering and Computer Science Department Member Life-long Continuing Education Committee (Mr. Ross pledged endowment to the EE/CS Department for the Doug Ross Career Development Chair of Software Technology at the Department's Centennial Celebration)

Mr. Ross' publications include over 30 publications and over 200 reports, contributed and invited papers, talks, panel discussions, and television appearances in his fields of interest. He was an organizer and participant in the NATO Software Engineering Conferences in Garmisch, Germany (1968), and Rome, Italy (1969). He is also co-author of the book, "Notes on Analog Digital Conversion Techniques," M. I. T. Press, 1959, and author of "Introduction to Software Engineering with the AED-0 Language."

Mr. Ross is a member of ACM, AAAS, Sigma Xi, and IFIP Working Groups: WG 2.3 on Programming Tools, WG 2.4 on Systems Implementation Languages, and WG 5.3 on Discrete Parts Manufacturing. He is a member of the ACM Special Interest Groups on Programming Languages, Operating Systems, Software Engineering, and Management of Data. He is on the editorial board of Software: Practice and Experience and on the editorial advisory board of Computers In Industry. He is also Chairman of the National Research Council Evaluation Panel for the Institute for Computer Sciences and Technology (ICST) of the National Bureau of Standards.

His past professional activities include: WG 2.1 on Algol 68, member of the editorial board of the IEEE Transactions on Software Engineering, ACM Principal Representative to USASI Section Committee X3-Computers and Information Processing Systems, Member X3 Systems Advisory Committee, AOA Steering Committee on Computer-Aided Design Technology, ACM Standards Committee, ACM Special Interest Committees on Symbolic and Algebraic Manipulation and Computer Graphics, ACM Programming Languages Committee, Program Committee Member and Paper Referee for Computing Reviews, Member of USASI X3.4.2 Programming Language Specifications, USASI X3.4.1 Committee on Specification Languages, USASI X3.4 on Programming Languages.

AWARDS AND RECOGNITION

Mr. Ross received the Joseph Marie Jacquard Award from the Numerical Control Society in 1975. In 1959 he was the recipient of the Outstanding Young Man of the Year Award in the Greater Boston area for 1958 from the Greater Boston Junior Chamber of Commerce. He also was recipient of The Distinguished Contributions Award from the Society of Manufacturing Engineers in 1980, and of the San Fernando Valley Engineers' Council's Honorary Engineer of the Year Award in 1981.

The paper, "Theoretical Foundations for the Computer-Aided Design System" co-authored with J. E. Rodriguez, now Senior Vice President of SofTech, received the Prize Paper Award at the AFIPS Spring Joint Computer Conference in 1963. The paper, "AED Approach to Generalized Computer-Aided Design" shared the Prize Paper Award at the 20th Anniversary National Meeting of the Association for Computing Machinery in August, 1967.

Mr. Ross was the General Chairman of the IEEE Specification of Reliable Software Conference, Cambridge, Massachusetts, April 3-5, 1979, and was the Banquet Speaker at the following conferences: the first PROLAMAT International Conference on numerically controlled machine tools in Rome, Italy, 1969; the IFIP Conference on Machine-Oriented Higher-Level Languages, Trondheim, Norway, 1973; and the PROLAMAT 79 Conference, Ann Arbor, Michigan, 1979.

OTHER RECOGNITION

1960	Selected as "Control Personality" by Control Engineering Magazine, September, 1960.
1979-1980	Listed in Who's Who in Finance and Industry, 21st Edition.
1980	Listed in Who's Who in the World, 5th Edition.
1982	Listed in Who's Who in Technology Today, 3rd Edition.
1983	Listed in Who's Who in Frontier Science and Technology, 1st Edition.

STATEMENT OF DOUGLAS T. ROSS, CHAIRMAN, NATIONAL ACADEMY OF SCIENCES EVALUATAION PANEL FOR THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY, AND CHAIRMAN, SOFTECH, INC., WALTHAM, MASS.

Mr. Ross. Thank you, Mr. Chairman. You have before you a rather voluminous volume of written testimony, including the oral remarks which I had prepared to present today. But with your permission, I will actually make some different oral remarks, because I think I have some views that are particularly pertinent to the committee. I would like to use them to try to clarify the situation still further. So I request that you please accept the written transcript including one correction which turns out to be significant.

I had updated the testimony which was presented last year to the Senate committee, but misunderstood this year's budget description figures. When I updated the recommendation of the Evaluation Panel that the slots for staff in ICST be increased by five, I put in the figure 95.

They have actually spent about 145 man years. I also hope that the subcommittee members themselves will, even though it is a large amount of material, at least try to get through the front part, through appendix A, because I really believe that this is a watershed year for ICST. The time is right for this subcommittee of the House and the committee of the Senate to finally take the proper action that is needed to put this very important governmental function on a sound, long-term footing. That is why I have chosen to redo once again my oral remarks, because I was myself, as a businessman, not sufficiently knowledgeable about what makes ICST able to perform as well as it does.

I would like to make sure that the subcommittee is fully aware of how that goes when the question of budgetary amounts and our recommendation for independent status for ICST come under serious consideration.

Hence, my independent remarks that I am giving now.

Mr. Brown. Mr. Ross, the full text of all of your statements will be included in the record at this point.

Mr. Ross. This is a watershed year, and I hope we can get some real bipartisan, definitive actions, because it is important that ICST have an independent status administratively outside of the National Bureau of Standards with its own budget and with new slots in order to allow it to perform its work and to stand alone and be measured on its own.

My job here today is to show that this view which very strongly comes from the Evaluation Panel, which has been in place, to consider just these types of questions; this view of our panel can be trusted to be the right decision.

That is what I think my role here today is.

Now, the key point is that ICST is far more than standards. The name tells the story. The Institute for Computer Sciences and Technology, and there is no other component like it in the Federal Government or in the State governments.

The nature of the job makes standards an important component, but we shouldn't be misled to thinking that ICST must stay or belongs permanently within the other parts of the standards activities, namely, where it has been in the NBS just because of that.

Its real function is to supply knowledge, guidance, and help as we have been hearing. Its new focus should be more on outreach, how to make its results available to more people both in the Federal Government, in our State and local governments, and the private sector.

ICST is needed to support the integration and interconnection of very complex technology. Now, my written testimony for the evaluation panel, plus the testimony we have had today from Senator Stuart and Mr. Greenlee, show definitively the breadth and depth and quality and utility of their work product.

Also, I would call to your attention the written testimony of Mr. Norman Ream, who has joined us again this afternoon, which he has submitted to clarify still further—the impossibility that the voluntary standards activities in the private sector can replace ICST's function. It is not true. It can't be done.

How has ICST evolved since 1979 when we put in the 5-year plan which they have been acting under? In the past, and it still is true for most of the NBS standards activity, if they couldn't perform a function, it didn't get done.

All the work was done in-house. The ICST 5-year plan, which came about because of great pressure from the Congress and the GAO and other portions of both the Government and private sector. Many studies showed that we needed a stronger program and we got it. The key item in that 5-year plan, besides the use of more funds, was using funds for outside contractors.

This gave the Institute access to special skills and views that they couldn't come up with themselves. It also has allowed them over the years to have more flexibility to watch the changing needs of their marketplace, and not have to take the time to build staff for a one-shot job and hold it forever.

It also allows a much broader coverge than the ICST itself could mount with its own staff. This whole concept of using outside contracting is of crucial importance to the success of the program.

Also, this activity with outside contracts and the broader base provides a good basis for selection of ICST research and competency areas. It allows ICST to understand what areas to direct their research toward and what is needed technically. It also allows the staff to stay in a leadership position. We have seen particular examples of that in recent years in the very important and much higher than normal speed of development of standards in interconnection. The use of the subcontractors also provides a base for determining what lab facilities are needed in ICST to perform its functions.

A recent example is the beginning of a microcomputer laboratory, much needed as we have been hearing from many sources. So the record shows that this was an excellent idea and has been working very well and still is improving. In fact, I would point out that the very activity that brings Senator Stuart here today with his important testimony to us was actually launched and gotten underway in this past year.

There are more activities of similar sorts, as the very skilled and professional staff under the leadership of director Jim Burrows undertakes to prepare the way for the things that are needed now and in the future.

ICST is useful to both the Federal, State, and private sectors directly, and this whole program of using outside contractors to do more than ICST can do inside allows their leadership in both the ANSI and the ISO roles.

The whole thing has been working so very well that it must be strengthened. More dollars and people slots are needed, because especially as our evaluation panel report stresses, we would like to see more outreach, more marketing of the results to be useful to all segments of government, Federal, State, and local, as well as the private sector, especially for the small people, the little companies.

That is preamble. The real story, and the reason that I decided to change my testimony today, is that I didn't understand as a businessman the important impact of this subcontracting on the financial structure that is required to keep ICST going and healthy.

I will take you through that. It has very important implications on the levels of funding and the funding rates, and their steadiness over time. I have a one-page addition, as if you didn't have enough pages already, which I would like to submit to the subcommittee I would like to explain the nature of these numbers, because, again, as a businessman, it very frequently turns out that the accounting functions and the way budgets are made and numbers are kept track of at the top levels of an organization turn out not to be exactly the kinds of view of what is going on that an active, dynamic, properly managed working component requires. So these are not numbers that come from any official source.

When I was pressing Jim Burrows for what really was the impact of various budget numbers, he said he had a view that had no official status and had too many things and was too hard to explain so he didn't try to use it but I have taken the risk here of submitting it because maybe I can walk us through at least enough of the important structure to see what I think is a very important point to be made today.

[The chart follows:]

D. Ross
83/3/22

OVERVIEW OF ICST FLOW OF FUNDS--TOTAL
(in thousands of dollars)

	FY'78	FY'79	FY'80	FY'81	FY'82	FY'83	
OBLIGATIONAL AUTHORITY							
STRS	$4,353.7	$11,267.9	$11,904.8	$12,348.3	$11,950.3	$10,124.7	
ADP Standards	(4,328.7)	(11,152.9)	(11,386.8)	(11,650.5)	(11,735.3)	(10,124.7)	
Competence	(0.0)	(100.0)	(507.0)	(687.8)	(200.0)	(...)	
SRM	(25.0)	(15.0)	(11.0)	(10.0)	(15.0)	(...)	
REIMBURSABLE SERVICES	2,304.0	1,775.2	1,272.3	842.8	882.8	855.9	
Other Agencies	(2,266.4)	(1,722.2)	(926.3)	(549.4)	(770.3)	(815.9)	
Expense & Income Accounts	(37.6)	(53.0)	(347.0)	(293.4)	(112.5)	(40.0)	
SUBTOTAL - NEW FUNDS	6,657.7	13,043.1	13,178.1	13,191.1	12,833.1	10,980.6	
CARRYOVER + PY DEOBLIGATIONS	31.3	121.9	665.8	210.5	832.7	515.9	
STRS-ADP Standards	(31.3)	(50.9)	(641.8)	(175.0)	(812.8)	(509.8)	
Reimbursable Services	*	(71.0)	(24.0)	(35.5)	(19.9)	(6.1)	
TOTAL	6,689.0	$13,165.0	$13,843.9	$13,401.6	$13,715.8	$11,496.5	
OBLIGATIONS						Thru 3/5/83	Full Year Estimate
LABOR BASED OBLIGATIONS:							
Labor (non-admin.)	2,798.6	$ 3,500.5	$ 4,367.1	$ 4,590.8	$ 4,460.6	$ 1,934.0	$ 4,641.6
Institute Admin.	1,039.2	1,252.5	1,384.0	1,690.7	1,601.0	679.1	1,629.8
Bureau Overhead	1,329.4	1,521.5	1,948.8	2,072.8	2,079.1	906.2	2,174.9
Subtotal	5,167.2	6,274.5	7,699.8	8,354.2	8,140.7	3,519.3	8,446.3
OTHER OBJECTS (excl admin)							
Travel	136.0	176.5	236.0	217.3	228.0	105.1	252.2
Contracts	644.3	4,903.5	4,156.7	2,397.0	3,442.3	504.9	1,770.0
NBS Contract Surcharge	0	221.0	161.2	103.1	152.6	23.7	83.2
All other	418.3	880.4	1,416.5	1,309.6	1,251.5	346.7	944.8
Subtotal	1,198.6	6,181.3	5,970.4	4,027.0	5,074.4	980.4	3,050.2
TOTAL	6,365.9	$12,455.8	$13,670.2	$12,381.2	$13,215.1	$ 4,499.7	$11,496.5
REFERENCE DATA							
CARRYOVER TO NEXT FY actual	112.3	638.2	172.7	814.8	384.6	0 NA	
UNBILLED COSTS with contracts	579.4	4,922.9	5,507.8	3,703.8	4,413.0	12 NA	

[illegible] to $1M

[illegible]

* Cannot be determined ([illegible])

Revised: 03/18/83, EJW

The first rule in preserving the viability of a business is to understand the real workings of that business, and here on one page, Mr. Chairman, I suggest we have precisely that kind of very important view.

It tells the story. Now, I will point out to you that in the middle there is a line labeled total. It shows that in fiscal year 1978 before the 5-year plan was put into place, they were operating at roughly $6.7 million.

Then they jumped, because of that infusion of funds and undertaking this new mode of operation, to a roughly steady $13-plus million a year operation, up until this past year. That is what I would like to address, because at the very bottom line of the page, there is a line called "unbilled costs."

It starts out about $500,000 to $600,000 and runs at $4, $5 and $4 million a year. That is the work that is in process in the pipeline from those subcontractors.

In other words, what the subcontractors do each year laps over the budgetary years, and the actual work product will be delivered to ICST in the next year and that is what the internal staff has to work on and package up to make this set of very important documents and guidelines that actually is the ICST work product output.

The important thing to notice is that the last column for fiscal year 1983 shows the near disastrous effect to this pipeline of the generous action on the part of Congress last year in increasing what was being proposed to $10 million. But notice the actual total amount that was available from all sources was $11½ million, not the $13 million that was required and that pipeline is drying up.

By the end of the year it will be $1.2 million instead of the healthy $4 to $5 million that it should be and has been running. That is what I thought was so important to bring to your attention, and I hope the Senate committee also will be cognizant of it because ICST needs at least the $13 million to maintain the level that we have come to expect and that their marketplace appreciates so much.

We have been eating our seed corn. The unbilled costs, if not addressed, are about to put the ICST back in the way, to its earlier pattern of not being able to supply what its users really need.

In order for ICST merely to stay even with its excellent track record, certainly not the $3 million that the administration proposes, and not even the $10 million that was made available to them last year, but an absolute minimum of $13½ million is an absolute necessity. Even so, ICST will have to work very hard with their subcontractors to refill that pipeline.

The minimum level for fiscal year 1984 should be set at $15 million, I suggest, with as our more elaborate testimony states, five new slots, one of them a major slot, so that not only can they continue to broaden their program, but can add the outreach and marketing program that we feel is so important.

There is more to the story still. Our proposed independent status for ICST also fits very well into this picture that I have been painting and further justifies action this year by Congress and the Senate, working together.

You see on the page a three-line segment called labor-based obligations. Almost half of that cost is for NBS overhead and administration. By the nature of NBS, ICST historically has always been burdened with many functions and features of overhead that it can't possibly use.

It is the smallest component in a huge laboratory, and many things slosh over into overhead. If the ICST is given independent status, it can independently contract for, maybe back to NBS, only the overhead functions that it actually needs and can use—those functions of personnel, contract administration, operational administration, and services of that sort.

The much lower overhead charges would mean that much more of the $15 million that we propose would go to productive ICST work. Thus there is an additional synergism in our proposal.

Let me stress, Mr. Chairman, that the very fact that Mr. Burrows had such a sheet to come up with shows me, as a businessman, that he knows how the actual business of ICST operates. That demonstrates to me at least that he and his staff are fully qualified and prepared to operate ICST as a fully independent entity of the Government.

They should be given that chance. Notice that the full recommendation of the Evaluation Panel stresses the need further for research and competency money, in addition to the $15 million I am talking about, and up to 20 percent of other agency-reimbursed funds because that, too, is a component of the program that is very important and has had to be sacrificed in the last few years.

It should be put back. Therefore, I stand on and will defend most strongly the full recommendation of our panel in my written testimony for a $20 million ICST program, independent of NBS.

Thank you very much for allowing me so much time to tell you this story, and I would be happy to answer any further questions you may have.

[The prepared statement of Mr. Ross follows:]

SOFTECH

TRANSCRIPT OF ORAL TESTIMONY OF DOUGLAS T. ROSS,
CHAIRMAN, ICST EVALUATION PANEL TO BE PRESENTED TO THE
SCIENCE, RESEARCH, AND TECHNOLOGY SUBCOMMITTEE
CONGRESSMAN DOUG WALGREN, CHAIRMAN MARCH 23, 1983

Mr. Chairman and Members of the Subcommittee:

I would like, first of all, to thank you for this opportunity to be heard on a matter which I think is of vital concern to our country. In one sense, I appear before you as the Chairman of the Evaluation Panel established under the National Research Council of the National Academy of Science and the National Academy of Engineering to evaluate the program and performance of the Institute for Computer Science and Technology, known as "ICST". I am pleased to offer a portion of my testimony in that capacity. But, as with all Congressional testimony, I also appear before you as an individual citizen, and I hope that the primary weight of my remarks to you will be interpreted in that light, because I appear before you unfettered by any constraints other than the boundaries of my own vision and experience. One month from today I will have been out of office as ICST Evaluation Panel Chairman for exactly one day, having completed my last meeting of six years total on the Panel, the last three as its Chairman -- so I am here today as a "lame duck". I intend to take advantage of the freedom to speak my mind directly and forthrightly.

My name is Douglas T. Ross, and I am Founder and Chairman of SofTech, Inc., a publicly held company based in Waltham, Massachusetts, with several branch offices around the country. The bulk of our business is in the design and implementation of custom software for government and large national and international companies, but also the fastest growing segment comes from our wholly-owned subsidiary, SofTech Microsystems, based in San Diego, which has exclusive world-wide rights to license manufacturers and applications developers to use and distribute our microcomputer software products which are based on the UCSD p-System, originated at the University of California in San Diego. Before founding

SofTech with my colleagues in the summer of 1969, I was at MIT for eighteen years, as Head of the Computer Applications Group of the Electronic Systems Laboratory, and Lecturer in the Department of Electrical Engineering. As my written submission outlines, during the 1960's I spent almost ten years as a very active participant in the American National Standards Institute, known as "ANSI." I served on almost every committee and subcommittee which has to do with the standardization process for computer hardware, software, communications, and storage media, and I also was deeply active in standards work in the Association for Computing Machinery, known as "ACM", one of the primary professional societies in the computer field. I also happen to be personally responsible for one of the current international standard languages, "APT", the Automatically Programmed Tool Language for the programming of numerically controlled machine tools in manufacturing.

I apologize for this lengthy introduction, but I wanted to make sure that you understood the background from which I speak, because some of my remarks may seem strong and controversial. I speak directly and sincerely from many years of concern and many years of active experience. But more importantly I speak to you today, from today -- and, I hope I speak for our entire industry, in which I include not only the researchers, the developers, the vendors, and suppliers, but also the customers and users in government, in industry, in business, banking, education, and the home -- all of our people. We all have been undergoing a radical change in just the last few years, as the sweep of computers undergoes the revolution of microchips, speed, and intercommunication. The whole of world society is being impacted by what we consider here today. You know that; I know that; the subject need not be belabored.

What I do intend to belabor is miniscule in any absolute terms, but of enormous magnitude in real terms. As a fraction of our total Federal budget, any conceivable budget for ICST would be vanishingly small, but in terms of what it means to our country, it is very important indeed. In 1978, my second year on the Evaluation Panel, we recommended $22 Million for a fully warranted ICST Program, and here for FY 84 we are faced with a Budget recommendation of $3 Million! A greater than 7-to-1 difference, not even taking account of inflation, signifies far more than mere attempts at cost saving. It demonstrates a fundamental lack of understanding of what the role and function of ICST is all about. That is the subject on which I wish to address you. I believe that your Subcommittee, and the companion Senate Committee, can, should, and will take the necessary steps to set this matter right, in a fully bi-partisan manner -- for the long term as well as the short term, for the good of our country and the world at large.

The history of ICST is exhaustively covered in my written testimony. Suffice it to say that since FY 1979 ICST has been making excellent progress in carrying out a well-structured 5-year Plan, in spite of budget and personnel allotments that have consistently been below the ICST and the Evaluation Panel recommendations. ICST is well organized and staffed with dedicated professionals who have performed extremely well with the resources at their disposal. Again, my written submission covers not only their many achievements, but also includes many expressions of appreciation and encouragement from many private sector, government, and international organizations with whom they interact. I am confident that Subcommittee Members or members of their staffs who study this material will concur with my contention that the proposed 7-to-1 reduction can only come from lack of understanding of what really has been going on in the ICST world and how the real world really operates.

My primary thesis lies above these facts of the matter, however. Last year the main thrust of these hearings was to remove ICST entirely from the National Bureau of Standards and implant it in another branch of government. Many were surprised that in written testimony submitted to the Senate Committee on Commerce, Science, and Technology, speaking for the Evaluation Panel, I said "It is highly appropriate to remove ICST from competition with the larger programs of the National Bureau of Standards (NBS) during this time of severe budget limitations, and strengthen it so it can stand on its own." This view was not taken lightly by the Panel then, and I have included intact not only that voluminous written testimony but also draft material I excluded last year that documents why we lack faith in the NBS Administrators to provide adequate backing for ICST under these conditions. In fact, I can only conclude from this year's $3 M proposal that NBS is itself saying, as it did last year, if there is to be an ICST function, let it be done elsewhere.

I submit that it is simply not working out well for the Congress to force increased allocations for ICST on a reluctant NBS year after year. Even in its heyday of 1978, the 5-Year Plan and increased budget for ICST was not strongly championed by NBS itself but was pulled through by a Department of Commerce Assistant Secretary who was himself previously the Chairman of the ICST Evaluation Panel, the post I now hold. Just as we recommended last year, ICST should remain physically at NBS for logistical reasons this year, as well, but I most sincerely hope that the Congress will take some definitive action this year on the remainder of our recommendations.

Although the 1978 5-Year Plan for ICST placed much emphasis on FIPS documents (Federal Information Processing Standards), an examination of the 96 FIPS listed through December of 1982 shows that 6 are Program Information Documents, 33 are Guidelines, and only 57 are actual Standards. Also in FY 1982, 36 Information Reports are listed, and a list of Information Exchanges shows 13 ICST sponsored or co-sponsored conferences and workshops, many with hundreds of attendees. This is education and information transfer, not standards, as such. Add to this the membership and chairmanship of ICST staff on about 60 national and international standardization and professional bodies, and its many cooperative and collaborative interactions with Federal and State government, industry, and academic groups and individuals, and it is clear that the total ICST function is much broader than mere drafting of standards alone. And this does not take into account the education, support, and clearing-house information gathering and dissemination functions the Evaluation Panel thinks should be added or increased, nor does it cover the unique ICST research activities that also should have increased funding.

I mention these few specifics to show that the past labelling of ICST efforts as "standards" work should not distort our understanding to the point that we think that ICST automatically must be made a part of the National Bureau of Standards. ICST's real function is rapidly evolving to be more of a center of expertise, a center for information, a technical resource, for analysis, research, and to act as an ombudsman for weak or diffused segments of vendors and users of everything related to computers and their use. No other government or private sector organization duplicates or can take over its unique role. Standardization aspects are a crucial component, but are only a part of the total picture. Our country and the world at large needs a healthy, active ICST function.

To me, the most encouraging part of the last few turbulent years of ICST has been the indisputable fact that that small group of dedicated professionals has been able to formulate and follow through so successfully in meeting their mandate and expanding it to satisfy the real user needs. I would be proud to have such a group as a part of my own organization. They have demonstrated that if the Congress does see fit to give them independent stature as a viable component of our government scene, they can indeed do the job and do it very well.

Therefore, Mr. Chairman and Members of the Subcommittee, I commend to you the same program our Evaluation Panel presented last year to the Senate. The Senate testimony of last year, included in my submission to you this year, shows that because of its unique role every dollar invested in ICST will be returned many times over through savings in the Federal government alone, but the actual values are even much greater. Based upon my years of work and experience in the field and knowing the people and programs of ICST, I most sincerely recommend the following:

1. ICST be left physically where it is at NBS so there is no disruption regarding space, contacts, and working environment, but that ICST be removed organizationally from NBS.

2. An ad hoc Blue Ribbon Panel for the Interim Management of the ICST be selected and be empowered to advise the ICST Director in an active top-management role. In order not to require any immediate amendments to the Brooks Act at this time, this Blue Ribbon Panel should report to and advise the Office of the Secretary of Commerce, as the Secretary may delegate.

3. ICST be granted at least five new personnel slots (to 97, total), with at least one at top GS level, so that new Clearing House, Education, and User Relations functions can be established and managed, and so that Other Agency work and funding can be accepted and performed well.

4. The total budget for ICST for FY 1983 be set at $15-20M, including Other Agency funding, as it may be acquired by ICST, up to 20% of its total budget, and 5-10% for Competency Research, so that all aspects of the Brooks Act mandate are met.

5. The ICST Director be charged to 1.) update the current 5-Year Plan to reflect these changes, permitting the Blue Ribbon Panel to perform its role knowledgeably and, 2.) with counsel from that Panel, from the ICST Evaluation Panel, and from others, to establish goals and budgets for subsequent years. An integral part of this planning process must be support for the decision-making regarding the long-term proper home for ICST including all of its ramifications.

6. Some provision be made for the combined Congressional and Executive branches of Government to make use of these Interim Steps to establish a permanent home for ICST that can supply management understanding and support of its mission, and a stable budget.

And now, Mr. Chairman, anticipating some of your questions, let me say in response to the obvious query: "How much of the ICST program do you think could be accomplished with the $3 Million allocation recommended by the Administration"s budget?" -- My answer is: "None!" I am sure that the ICST Director would do his best, but the result would bear no resemblance whatsoever to the productive, dynamic program that has been built up over the past few years and which should be expanded, not decimated. The Evaluation Panel is grateful for the Congressional increase of last year's recommended $7 Million to $10 Million and cites the ICST Director's testimony on accomplishments this past year as evidence of the wisdom of that action. We hope even more can be done this year.

The other obvious question is: "What could be accomplished with a $15 Million base budget for ICST?" My first reply would be that the additional personnel slots, although not a life-or-death matter, would greatly assist the ICST Director and the Evaluation Panel in wisely accommodating such a sensibly-sized increase for this year. Not only could Other Agency work increase the total toward $20 Million, total, but new leadership-level talent of an educational and marketing type could be brought in to expand ICST's role into the Information Clearing-house field. I would prefer that the Director and Managers of ICST themselves recommend the exact program to be followed for they are the professionals in this field, and I am sure that the Evaluation Panel would schedule special sessions to interact with them on selections and priorities. My personal emphasis would be to structure the total ICST program to be one of solid outreach -- much along the lines of a successful Custom Consulting and Support business, directed toward the thousands of Federal and State governmental departments who are their primary marketplace, but, as at present, with every important component also available and targetted to the private sector as well. Television, books, brochures, courses, and conferences would not only spread the good results, but also would improve the awareness of what ICST has to offer. No matter what the specifics of the program may be, as a businessman I can guarantee that such an outreach component would magnify the already considerable returns and remove any possible question of ICST's effectiveness and value to the nation.

Thank you very much for this opportunity to speak. I will be happy to answer any further questions to the best of my ability.

Mr. **Brown**. Thank you, sir. Does your submission include information with regard to the makeup of the panel and some data on previous panel reports?

Mr. **Ross**. Yes. In fact, Dr. Ostenso has the complete color-marked copy we did on the original submission to the Senate. The color marking in that set of the Evaluation Panel reports going back to the year 1970 or 1971 shows the various levels at which the panel has both been heeded and not heeded, and the places where money has always been well justified and hard to come by.

Mr. **Brown**. The material includes the process by which the panel was appointed? This is an Academy panel.

Mr. **Ross**. Yes, I am sure we can supply to the committee a complete description of also this year's Evaluation Panel and report. It has just this afternoon gone to the printers in its final form and we will supply a copy of that.

[The material referred to follows:]

NATIONAL RESEARCH COUNCIL
COMMISSION ON PHYSICAL SCIENCES, MATHEMATICS, AND RESOURCES
2101 Constitution Avenue Washington, D.C. 20418

Board on Assessment of
National Bureau of Standards Programs

OFFICE LOCATION:
JOSEPH HENRY BUILDING
21ST STREET AND
PENNSYLVANIA AVENUE, N.W.
(202) 334-3483

April 25, 1983

Honorable Doug Walgren
Chairman
Subcommittee on Science,
Research and Technology
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Walgren:

I wish to call to your attention the enclosed report on the Institute for Computer Sciences and Technology (ICST) of the U.S. National Bureau of Standards. The Panel that prepared the report meets annually to provide an external assessment of the programs of ICST.

The Panel is particularly concerned about resources, budget, and the proper organizational location for ICST. The report points out the benefits that accrue to the U. S. Government and the private sector from ICST programs. The report stresses the importance of U.S. Government participation in national and international standardization activities in the computer area. The report calls for a more balanced ICST program to include more research, more reimbursed other-agency work, and new clearinghouse and educational functions for ICST.

I am also enclosing a list of addresses of the current members of the Panel.

Sincerely,

Gary E. Clark

Gary E. Clark, Staff Director
Board on Assessment of NBS Programs

Enclosures

cc: Tom Kramer
Carol Pompliano

Institute for Computer Sciences and Technology

Mr. James H. Burrows, Director
Institute for Computer Sciences and Technology
National Bureau of Standards
Administration, A200
Washington, DC 20234
(301) 921-3151

Under authority delegated to the Secretary of Commerce by Public Law 89-306, the Institute for Computer Sciences and Technology provides scientific and technical services to the central management agencies (e.g., the Office of Management and Budget and the General Services Administration) to support the formulation of Federal ADP policies; develops and recommends Federal Information Processing Standards and participates in the development of voluntary ADP standards; conducts research in the science and technologies of automatic data processing, computers, and related systems; and provides direct technical assistance to other Federal agencies in solving specific computer applications problems.

PANEL FOR THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY

Mr. Douglas T. Ross, Chairman (1983)
Chairman
SofTech, Inc.
460 Totten Pond Road
Waltham, MA 02154
(617) 890-6900

Prof. Bruce W. Arden (1983)
EECS Department
Engineering Quadrangle
Princeton University
Princeton, NJ 08544
(609) 452-4640

Dr. Walter F. Bauer (1983)
President
Informatics Inc.
21031 Ventura Boulevard
Suite 800
Woodland Hills, CA 91364
(213) 887-9040

Prof. J. Daniel Couger (1983)
University of Colorado
Austin Bluff Parkway
Colorado Springs, CO 80907
(303) 593-3403

Mr. John A. Gosden (1983)
Vice President
Equitable Life Assurance Society
1285 Avenue of the Americas
New York, NY 10019
(212) 554-2323

Mrs. Shirley F. Prutch (1983)
Vice President
Martin-Marietta Data Systems
6801 Rockledge Drive
Bethesda, MD 20817
(301) 897-6368

Dr. Robert J. Spinrad (1983)
Vice President, Research
Xerox Palo Alto Research Center
3333 Coyote Hill Road
Palo Alto, CA 94304
(415) 494-4020

Mr. Bernard Strassburg (1982)
9708 Saxony Road
Silver Spring, MD 20910
(301) 681-5891

Mr. Charles A. Zraket (1982)
Executive Vice President
The MITRE Corporation
Burlington Road
Bedford, MA 01730
(617) 271-2356

An Evaluative Report on the

INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY

National Bureau of Standards
Fiscal Year 1982

Evaluation Panels for the National Bureau of Standards
Commission on Physical Sciences, Mathematics, and Resources
National Research Council

NATIONAL ACADEMY PRESS
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NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

The National Research Council was established by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and of advising the federal government. The Council operates in accordance with general policies determined by the Academy under the authority of its congressional charter of 1863, which establishes the Academy as a private, nonprofit, self-governing membership corporation. The Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in the conduct of their services to the government, the public, and the scientific and engineering communities. It is administered jointly by both Academies and the Institute of Medicine. The National Academy of Engineering and the Institute of Medicine were established in 1964 and 1970, respectively, under the charter of the National Academy of Sciences.

This study was supported by Contract NB 82 SBCA 1505 between the National Academy of Sciences and the National Bureau of Standards, an agency of the U.S. Department of Commerce.

Copies available from:

Evaluation Panels for NBS
2101 Constitution Avenue, NW
Washington, DC 20418

EVALUATION PANELS FOR THE NATIONAL BUREAU OF STANDARDS

Steering Committee

Chairman: Mildred S. Dresselhaus
Massachusetts Institute of Technology

Howard W. Emmons, Harvard University

Norman Ramsey, Harvard University

Douglas T. Ross, SofTech, Inc.

William P. Slichter, Bell Laboratories

Staff Officer

Gary E. Clark, Director, Evaluation Panels for NBS
National Research Council

EVALUATION PANELS FOR THE NATIONAL BUREAU OF STANDARDS

General Information

Since 1959 the National Research Council has provided a continuing evaluation of the functions and operations of the National Bureau of Standards of the Department of Commerce. In discharging this responsibility, the National Research Council selects and appoints members to a series of Evaluation Panels. Administratively, the Panels are attached to the Commission on Physical Sciences, Mathematics, and Resources.

The success of the project to provide an evaluation of the total technical effort of NBS depends largely on the selection of capable people who have the expertise necessary to cover all the activities of the Bureau. The scientific disciplines covered by the programs of the National Bureau of Standards are diverse and encompass almost all fields of physical science. Panel members are drawn from among the leaders in various fields of research and administration in industry, government, and universities. The term of a Panel member usually lasts for 3 years and is never longer than 6 years.

It is the responsibility of the Panels to review and evaluate the technical functions and operations of NBS. They consider importance and relative priority of projects, quality of staff, equipment needs, finances, and the relation of the program to the mission of the Bureau. They provide a continuing contact between the scientists and engineers of the academic and industrial communities and the Bureau staff.

There are Panels for the major technical organizational units of NBS: the National Measurement Laboratory, the Institute for Computer Sciences and Technology, and the National Engineering Laboratory. These Panels examine broad technical policy. In addition, they review and coordinate the work of various subpanels that look at specific program areas.

Guidance and general oversight to the Panels are provided by a Steering Committee. The membership of the Steering Committee is comprised of the chairmen of the Panels for each of the major organizational units of the Bureau and additional members.

Specifically, the Steering Committee reviews and coordinates efforts of the Panels, identifies major problem areas in the technical programs, and draws attention to the issues that are common to several organizational units. It is also the Committee's responsibility to identify problems and issues that, in its opinion, should be called to the attention of the Statutory Visiting Committee, which reports to the Secretary of Commerce.

Each Panel is asked to prepare a written report. These reports are then collected and, after appropriate review by the Academy, delivered to the Director of the National Bureau of Standards. They are also available to the public.

PREFACE

This report presents an evaluation of the technical functions and programs of the Institute for Computer Sciences and Technology, one of the major organizational units of the National Bureau of Standards. This report has been reviewed by the Steering Committee of the Evaluation Panels for NBS and outside reviewers.

Readers should keep in mind that this report deals with only a part of the total NBS effort. The scope and point of view appropriately reflect that fact. The reports of Panels that evaluate other parts of the Bureau will be published separately. When the reports of all Evaluation Panels are available, the Steering Committee considers the implications of their findings in terms of the NBS mission, the total NBS technical effort, and the needs of the nation. Common problems are identified, possible solutions are suggested, and significant developments are highlighted. These overall findings and recommendations are then made available in an overview report from the Steering Committee.

The evaluation program was supported during fiscal year 1982 by Contract NB 82 SBCA 1505 between the National Academy of Sciences and the National Bureau of Standards, an agency of the U.S. Department of Commerce. This report has been delivered to the Director of NBS in partial fulfillment of the contract.

On behalf of the Academy I would like to thank the members of the Evaluation Panels and the Academy staff who have participated in this project. In addition, the helpful cooperation of the staff of NBS is acknowledged.

Mildred S. Dresselhaus, Chairman
Steering Committee

AN EVALUATIVE REPORT ON THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY

Evaluation Panel Members

Douglas T. Ross, SofTech, Inc., Chairman
Bruce W. Arden, Princeton University
Walter F. Bauer, Informatics General Corporation
John A. Gosden, Equitable Life Assurance Society
Shirley F. Prutch, Martin-Marietta Data Systems
Bernard Strassburg, Consultant, Silver Spring, Maryland

Unable to Attend

J. Daniel Couger, University of Colorado
Robert J. Spinrad, Xerox Corporation
Charles A. Zraket, The MITRE Corporation

This report, submitted for the Panel by the Chairman, Douglas T. Ross, covers the activities of the Institute for Computer Sciences and Technology during the 12 months preceding the Panel meeting on November 19-20, 1981. The report also covers some developments that occurred after the Panel meeting.

Functions of the Institute

Under authority delegated to the Secretary of Commerce by Public Law 89-306 (the Brooks Act), the Institute for Computer Sciences and Technology (ICST) provides scientific and technical services to the central management agencies (e.g., the Office of Management and Budget and the General Services Administration) to support the formulation of federal automatic data-processing policies; develops and recommends Federal Information Processing Standards and participates in the development of voluntary automatic data-processing standards; conducts research in the science and technologies of automatic data processing, computers, and related systems; and provides direct technical assistance to other federal agencies in solving specific computer applications problems.

During fiscal year 1982, the Institute had a staff of about 121 and a total operating budget of approximately $12 million.

Introduction

The Panel believes that ICST performs a unique and valuable role for both the government and private sectors. Since 1978 ICST has had a well-structured 5-year plan, and, although only partially funded, that plan has been working well and effectively within the limitations imposed. ICST management and staff have demonstrated that they can do the needed job.

To perform its Brooks Act mandated functions of (1) standards program development and management, (2) assistance to other government agencies, and (3) research and development in computer science and technology, ICST should have the resources and budget needed for a balanced program and a stable organizational environment with top management well attuned to the special needs of ICST. Problems of resources, budget, and the proper location for ICST must be addressed wisely and carefully because the explosive growth of computers in government and the world economy requires that the ICST functions be geared for the future.

Proposed Transfer of ICST

It has been proposed that ICST be transferred out of the National Bureau of Standards (NBS) and attached to the General Services Administration (GSA). To this aim, two bills were introduced into Congress.

Bill to Transfer ICST to GSA (S. 2306): This bill was introduced by Senator Roth (at Administration request) on March 30, 1982, and referred to the Committee on Governmental Affairs.

Bill to Transfer ICST to GSA (H.R. 6006): This bill was introduced by Congressman Brooks on March 31, 1982, and referred jointly to the Committees on Government Operations and Science and Technology. At the time of writing this report, no action had been taken on either bill.

The choice of GSA as the recipient agency is not surprising. The management concept of the Brooks Act of 1965 gave responsibilities to three agencies. The GSA would manage the procurement and utilization of automatic data-processing (ADP) systems. The Department of Commerce (through ICST) would recommend ADP standards and render technical support. The Office of Management and Budget (OMB) would furnish policy direction and resolve conflicts. In 1973, Executive Order 11717 transferred essentially all residual functions of OMB (including the approval of standards) to the Department of Commerce. This substantially broadened the role of ICST to include the principal responsibility of government-wide standards policies and the management of the standards development and implementation process. Thus, two agencies, ICST and GSA, now share the responsibility for implementing the Brooks Act.

An alternative proposal is to transfer ICST out of NBS and attach it to some other part of the Department of Commerce. At the time of writing this report, no action had been taken to achieve this transfer.

Of course, it is possible that, in the end, ICST will continue as an organizational unit of NBS. However, the fact that two bills have been introduced in Congress shows the seriousness with which a transfer of ICST has been considered. In the following several sections of this report, the Panel offers its comments on the subject.

A Recommended Interim Solution

The Panel believes that it may be appropriate to remove ICST from competition with the larger programs of the National Bureau of Standards during this time of severe budget limitations and strengthen it so that it can stand on its own. In order for ICST to continue the excellent progress it has been making and to accelerate toward the needed funding levels for countering at least some of the inflationary effects of the last few years, it is strongly recommended by the Panel that the following steps be taken as an interim solution:

1. ICST should be left physically at NBS so there will be no disruption regarding space, contacts, and working environment, but ICST should be removed organizationally from NBS.
2. ICST should be granted at least five new personnel slots, with at least one at top salary level, so that new clearinghouse, education, and user-relations functions can be established and managed and so that other-agency funding can be accepted and the work performed well.
3. The total budget for ICST for fiscal year 1983 should be set at $15 million to $20 million. This includes other-agency funding, as it may be acquired by ICST, of about 20 percent of its total budget and 5 to 10 percent for competence research so that all aspects

of the Brooks Act mandate are met.

4. The ICST Director should be charged to update the current 5-year plan to reflect these changes and, with counsel from the ICST Evaluation Panel and others, to establish goals and budgets for subsequent years. An integral part of this planning process must be a consideration of the long-term proper home for ICST.

5. Some provision should be made for the combined Congressional and Executive Branches of government to make use of these interim steps to establish for ICST a permanent home that can supply a stable budget and management understanding and support of its mission.

An Opportunity for Congress to Save Money

An Act of Congress established the functions of ICST within the Department of Commerce, and congressional action would probably be required to move it to another agency. The special mandate for NBS as a whole is the Organic Act of 1901. The mandate for ICST is the Brooks Act of 1965. ICST is unique in this respect in NBS.

The need for congressional action provides an opportunity to address directly the need for and role of an effective ICST function in the government and also to focus on questions of how much funding and how many personnel slots are required to enable ICST to fulfill that function independently of any other consideration. This is highly appropriate, especially now, when budgetary questions are of highest priority, because the ICST function is probably unique in all of government from the standpoint of a high return on investment. The Panel knows of no other place in government where one dollar spent well and wisely offers almost guaranteed cost-saving to the federal government on a continuing basis. The questions of ICST should not be about how much it costs but how best to free up and support (by organization, management, policy decisions, and actions) the unique ability of ICST functions to save costs elsewhere in government at a rate far greater than ICST funding costs. Such absolute savings in cost of government benefit every citizen directly.

Inefficiencies Create the Necessity for Standards

The unique benefits of ICST functions stem directly from the pervasive inability of government and society as a whole to function today without the use of computers. Computers have been propelled into this indispensable role at a rapid pace because of their cost-effectiveness in many areas. However, many inefficiencies in their use have crept in. It is this combination of indispensability and inefficiencies, all at the same time, that leads to the guaranteed high payoff from efforts to provide guidelines and (where possible) standards for the better use of computers. That is precisely the mandate and function of ICST. There is no other government agency that duplicates or overlaps the sweeping charter of ICST, and every government agency and much of the private sector stands to benefit directly from enabling ICST to fulfill its charter.

U.S. Government Share Is Only about 7 Percent

Although less than 30 years old, the computer hardware, software, and systems business is a big industry--so big that even though the U.S. Government is by far the biggest single customer of that industry worldwide, it still accounts for only about 7 percent of the total U.S. market. This situation needs to be next taken into account when addressing questions about ICST. Why should not the government forget the ICST program and merely shop for the best bargains in the computer marketplace? Indeed, a significant component of the ICST mandate is to assist and make more effective the other agencies of government in doing precisely such shopping through effective specification and procurement practices. This is one of the most visible areas where ICST results can help the federal government save millions of dollars.

Government Share Is Highly Influential

The argument that the 7 percent share can significantly affect the rest of the computer industry market really has relevance to the government ICST program through the concept of influence. Technical improvements cost money. The use- and customer-oriented Guidelines and Recommended Policies today are even greater in number and more important than actual standards in the ICST product output. These guidelines and policies require that some technology and product-offering adjustments be made by the suppliers, and those changes cost money. Except for exotic changes, for which the military expects to pay full price, most of these improvement costs are spread by the industry vendors over the full 100 percent customer base, resulting in low individual costs. The government's 7 percent is highly influential indeed. This points out another facet of the complex ICST situation that could be the primary focus of attention in an era of not-so-tight budgets. However, it takes a subordinate role to the current all-important cost-saving benefits.

The Private Sector Also Benefits

The ICST role and function, by the nature of the complex computer industry, is much a service-to-the-citizen function. The same benefits that accrue to the government's 7 percent apply to the private sector's 93 percent. In absolute numbers, the people and funds, and even the specific Guideline and Standards output products of ICST, may be small; but their beneficial effects are large. A healthy, well-positioned, well-managed ICST is important to our country. The original Brooks Act was well directed and well intentioned. Congress can use today's difficult circumstances to justify efforts to improve the ability of ICST to fulfill its role.

U.S. Free-Market Standardization

In order to tap the government's potential to influence the entire computer industry, it is essential that ICST participate actively and directly in industry efforts to achieve standardization and compatibility of system and component interfaces. Only by ensuring that the much-larger private sector will find the changes acceptable can the government-based needs benefit from the economies of scale. This is a particularly intricate undertaking in the American free-market, antitrust-constrained way of addressing standards. Most countries have government-sponsored standards programs, and they enforce resulting standards as a matter of law. In the United States, however, the standards activity, including participation by ICST and other government agencies, is entirely voluntary through organizations such as The American National Standards Institute (ANSI) and various business and professional organizations. These organizations, in turn, interact with The International Organization for Standardization (ISO), for the computer industry is international in scope and market.

Benefits from Sound Government Participation in Standardization Activities

Over the years, and within its personnel and budget constraints, ICST has played an effective participative and (sometimes) leadership role in the national and worldwide standards activity. Standardization activity is always competitive and is often coercive, as the business implications give large companies extra weight, pro or con. ICST participation is needed not only to have government concerns properly weighed in the balance but also to help represent the weaker elements of the public sector. The fact that Federal Information Processing Standards (FIPS) can be required in government procurements is frequently an important factor in these private-sector deliberations. The FIPS program is the major focus of ICST. Although the adoption and enforcement of FIPS is not an ICST function, FIPS are issued, maintained, and interpreted by ICST. ICST is one of the most influential contributors to standardization. Again, the benefits come from the delivery of results that are acceptable from a technical and business point of view, so that competition is focused on improvement of delivered results, and economies of scale are allowed to operate in a more orderly marketplace. Success yields significant monetary and performance benefits to the government and private sector alike.

There Should Be a Balanced ICST Program

The ICST FIPS program for Guidelines and Standards at present consumes almost all of the total ICST resources. In one sense this is fortunate, for the FIPS work is indeed the technical underpinning of the ICST program. Unless the work product (almost 100 FIPS-numbered documents) were there to be used, the program goals could not be met. But the current narrow focus of ICST on FIPS is entirely a consequence of historic understaffing and underfunding. There are many more functions that ICST could, and should, and wants to address, and it is important that as ICST moves into a more visible and demanding role, the full, balanced program be given a chance to demonstrate its value to the nation.

The ICST competence research program, which was favorably reviewed by the Evaluation Panel in November 1981, is one of the areas that need to be increased in a balanced ICST program. Often the competence programs of NBS have been cited as essential to attract, maintain, and vitalize competent technical staff. This is especially true for ICST, because much of the detailed work of standards preparation and evaluation is, by its nature, focused on conservative, mundane subjects, relative to narrow fields of interest. But to perform well, those who do the standards work must be up to date in the field and of the highest caliber--often with a broader, more encompassing view than their compatriots. Thus a healthy mix of forward-looking research and development is essential to the overall staff competence. An active research program tied into important standards work also allows appropriate visiting staff and collaborative efforts to be mounted with industry and other organizations. Also, the Panel believes that ICST research and development is itself of value for its direct results. ICST has done a good job of selecting subject areas that not only support basic standardization and metrology but also cover subject areas that are unique, useful, and not duplicated elsewhere. The Panel believes that ICST competence funding is well-spent research and development money.

Valuable, Reimbursed, Other-Agency Work for Relevance

It is regrettable that a shortage of people prevents ICST from performing much-needed, other-agency work that would be done on a reimbursable basis. The need for ICST expertise being available to other agencies continues to grow explosively. Significant additional ICST slots are needed to provide services to other agencies, and the Panel believes that this should be an important component of a balanced ICST program. It is only because of past limitations on resources that this component is low at present. When the recommended $22 million level of funding actually materialized as only $11.1

million in the 1979 plan, the personnel slots needed to support a viable and appropriate other-agency role also were not forthcoming. Both the FIPS focus and other-agency work could not be supported, so other-agency work dropped to a low level. This is unfortunate on three counts. (1) When other-agency requests to ICST must be turned down, the requesting agency must look elsewhere to probably less able and more expensive sources to fulfill their needs (or else have those needs go unsatisfied). (2) ICST loses a source of funds that would be well earned for the goods and services delivered, allowing it to fulfill its overall Brooks Act mandate more completely. (3) ICST management and staff are cut off from a valuable source of hands-on, real-world, ongoing experience that would be invaluable (along the same lines as the competence program) in keeping every aspect of the ICST total program well directed and on track.

New Clearinghouse and Education Functions

The Panel believes that ICST's programs and products are not well enough known--neither within the U.S. Government nor in the worldwide private sector. With proper slot and budget support, ICST could and should mount a major effort to enhance its role and to promulgate its results in the communities it serves. ICST always has had an active program of participation in national and international standardization and professional bodies, and it continues its support and leadership of jointly sponsored meetings with technical and professional societies. But much more of this sort of activity would be in order, and a broadened role as clearinghouse and source of expertise (see the 1981 Evaluation Panel report) would be of use to government and private sector and would ensure that the full ICST program is always up to date and directed toward areas of greatest utility and effectiveness. An increasing proportion of FIPS documents consists of guidelines rather than standards, and education on how to use these well-considered, organized approaches in many specific, as well as generalized, contexts could provide a greatly enhanced service role for ICST. When applied in the context of other-agency work, where huge projects and applications are involved, the payoff to the government would be large. In the private sector, the same class of benefits could yield even larger economic effects of a service nature that only ICST can provide.

Technical Focus to Support Policy Advice

There are additional possible roles for ICST in its new context--roles having to do with policy and administrative matters of government, which are related to the areas of ICST's computer hardware, software, and systems expertise. Historically, such policy and enforcement-related questions have been considered from time to time as appropriate for a complete ICST charter. But when these questions have been considered in recent Evaluation Panel discussions, they seem ill advised when compared to a balanced, technically oriented ICST program. ICST often is called on to analyze and prepare position papers on policy-related matters, and the program proposed here for ICST would permit advice embodied in such studies to be even more cogent and valuable. However, it is the opinion of the Panel that mixing policy or enforcement with the technical neutrality demanded of scientifically based objectivity probably would not be a good idea. Also, the possible expansion of ICST roles to strictly private-sector services, which also has been considered in the past, would have a tendency to dilute the government-for-all focus that is the real source of vitality and uniqueness for ICST. The Institute does not undertake work that can be done in the private sector. The Panel believes that this is a good policy.

INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY

Funding for ICST

Funded at approximately $11 million to $12 million annually for the past 3 years, ICST has demonstrated that it can develop needed federal ADP standards and guidelines in a timely manner. ICST's increased funding over its fiscal year 1978 level ($4 million annually) has made a significant difference in the scope and effect of the program. An initially proposed funding level of $7 million in fiscal year 1983 would have been effectively little more in real dollars than the $4 million fiscal year 1978 level, owing to inflation. Such a level of funding would jeopardize the ICST's ability to work with international voluntary standards development groups, computer manufacturers, and industry ADP users, and it would also jeopardize ICST efforts to carry out needed research in support of standards. Further, it would return ICST to the posture that was criticized by the Office of Management and Budget, Congress, and the General Accounting Office.

On the other hand, the preceding sections support a compelling case that increasing ICST resources to begin to remove some of the prior constraints and granting up to $15 million (or more based on further studies and an updated ICST plan) to counter the inflation of recent years would be an excellent investment. The total government would share in improved ADP management and cost savings, and the potential increased private-sector productivity spurred by new clearinghouse and educational functions would increase tax revenues, as well. There are few, if any, other government activities that offer such returns.

ICST Standards Program

The main charge of the Institute is to provide guidance, guidelines, and standards for the other groups (governmental, industrial, and educational) involved in the design and operation of computer and communication systems.

The Panel observed that the guidance and standards efforts are proceeding well. The number and variety of publications are impressive, and, more important, they have been well received by the governmental and industrial computing community. The activities related to networks and protocols were particularly noteworthy. ICST plays a central role in the complex international process of establishing standards for the several levels of network protocols. The importance of this task cannot be overemphasized, and the unique contribution of ICST is recognized by the Department of Defense and most computer vendors.

Panel members with expertise in the areas of software engineering and network modeling and design believe that most of the Institute's publications are current and destined to be influential. The vitality of this primary effort is apparent to the Panel. The laboratory demonstrations helped the Panel to assess progress in the network area.

ICST Competence Program

The NBS Competence Program is a Bureau-wide program to introduce needed new competences into NBS by funding specific projects for a limited time out of a special fund for competence building. The Panel believes that this has been a valuable program for ICST and finds it regrettable that there will be no new money for additional competence projects. Even more alarming to the Panel is that money for the current competence projects in ICST is being withdrawn. If alternative funding cannot be found for these projects, much of the work to date will have been done in vain.

The three competence efforts reviewed were in local area network messages and control, abstract data models, and intermediate program representation. The work undertaken appears to be uniformly good, although the size of the groups involved, particularly for the latter two areas, precludes voluminous results or the possibility of establishing leading research efforts. However, as long as the quality of work is good, the essential goal of attracting, retaining, and updating respected professionals to guide the Institute's primary mission will be well served. Stated another way, the maintenance of a competence program of reasonable size is inseparable from the main goals of guidance and the development of standards.

The need for progressive, governmental coordination of software and hardware developments was the motivation for the Brooks Act, and it was reaffirmed in the Paperwork Reduction Act. It was not always so, but now most computer vendors see this need as well and turn to ICST for leadership. The generation of standards in these fields cannot be done by physical experiments in an isolated laboratory; it requires the exploration of complex tradeoffs and the generation of a consensus. The network protocol activity is a paradigm for this process. It is essential to continue to support such functions in whatever organizational framework is most expeditious and to preserve the momentum that ICST has gained in recent years. Given the rapidly changing computer and communication technology, a lack of coordination now could introduce a level of chaos (and cost) that could negate the anticipated productivity improvements. The recent efforts of ICST can be shown to be cost-effective. The reduction in duplicated effort and incompatible systems at other federal sites amply justify the continued support and even an expansion of the ICST function.

Organizational Changes within ICST

The Institute now has two Centers, each with two Divisions. The Center for Programming Science and Technology has a Data Management and Programming Languages Division and a Systems and Software Technology Division. The Center for Computer Systems Engineering has a Systems and Network Architecture Division and a Systems Components Division. Both Centers have new Directors.

Over the next several years, the Center for Programming Science and Technology plans to produce guidelines for data and software management that will support ongoing operations and personnel as well as guidelines and standards for ADP planning, acquisition, and operation. The Panel believes that the Center should be more aggressive in marketing its products and that it should follow up on the guidelines that are developed to see whether they are actually being used.

Some important work in the Center for Computer Systems and Engineering is being done on network interfaces and protocol standards to make it possible to interconnect computers, peripherals, office systems, and networks. The Panel finds it regrettable that a shortage of people prevents this Center from doing other-agency work on a reimbursable basis.

Mr. **Brown**. Mr. Greenlee, Members of Congress, including myself, are amateurs in most of these esoteric fields, but I have a general understanding that one of the problems associated with the widespread development of improved information systems, electronic fund transfer systems, for example, is a matter that you have discussed in your statement of problems of privacy, secrecy and so on, and I would like to have you elaborate a little bit more on how you and ANSI relate to the Institute in connection with solving these problems.

You have discussed the problem of two proposed methods of safeguarding electronic funds transfer, for example, and I forget exactly what differentiates them, but I gather one is a computational algorithm, and the other is another type of system.

Is the Institute capable of establishing a standard methodology to provide the security that these systems need or can they do it by contract, or can they provide consulting advice to ANSI?

What role is it that you expect from them in this operation?

Mr. **Greenlee**. I think that the role is probably three-fold. First, in establishing Federal standards, for example, the Federal data encryption standard is the cryptographic technique in standard form that has been, if you will, transferred to ANSI, the private sector and the private sector security and authentication system. That is a system which guarantees when I send you a transfer, you know it was from me and I was authorized to send it.

Mr. **Brown**. Transfer of funds. Is that different from maintaining secrecy of communication. You want to send a message to your girlfriend and you don't want your wife to see it.

Mr. **Greenlee**. You really do have to exercise an extreme amount of care to be sure that when that message is sent, that you can receive it knowing no one has tampered with it.

I alluded to $2 million per transaction average, that is for commercial funds transfer, but we are also moving toward an area of home banking and home bill-paying service and to extend that one more notch, when perhaps a year out I wish to communicate with my brother in Charlottesville via my home computer, I would like to be able to have some privacy on that as well.

Mr. **Brown**. I recognize that development of this market for home financial services, it may depend upon the development of what you are talking about, and I am interested in the relative roles of the different actors in this.

Mr. **Greenlee**. I believe one way of viewing NBS is as a highly competent technologically based and trusted party in developing the standards.

One with an international reputation, one with the resources both within themselves, the ability to contract, and also very importantly, the ability to go to other Federal Government organizations and agencies to get additional support, for example, the NSA.

Mr. **Brown**. The NSA has had lots of experience with encryption, I understand, and I am wondering how that relates to the problem that faces our civilian commercial market place. Is the development that they have made for the protection of data of security relevance applicable to the problems of providing security in the civilian sector?

Is there an exchange of research in this area, or should there be, and what can we expect in this area?

Mr. **Greenlee**. During the last several years, we have had active support from the NSA, both through ICST and also I have a NSA representative as an observer on one of my working groups.

There is a fundamental problem in orientation of the organizations. Even though we have had superb support, they are a DOD organization, and they have access to a range and variety of technology that perhaps from a national defense standpoint would be inappropriate to share with the private sector.

Mr. **Brown**. You are familiar with some of the controversies that have been generated by the NSA's effort to exercise certain controls over, or maybe controls is too stiff a word to use, but over research in the cryptography field, like clearing research papers and that sort of thing?

I am not clear in my own mind what the justification for that is, but that is a separate argument.

What bothers me is that the security of this Nation could be screwed up just as much by a wide-scale interruption of the flow of money or the falsification of that flow of money by almost anything else I can think of and that means there should be some security concern by the NSA or other appropriate body for the success of the kind of work that you are describing as necessary to the electronic funds transfer.

Mr. **Greenlee**. One way, sir, to perhaps view this is that the NBS, in addition to providing a resource base, provides a conduit for questions from the private sector, especially in the financial area, to the NSA.

Mr. **Brown**. You are saying there is a close liaison between the Institute and NSA in this area?

Mr. **Greenlee**. In this area, yes, sir. I think that the result of the coordination of the efforts has been very positive, and I know, for example, that the two algorithms that have been proposed are by international laboratories, and I don't know how good that is in comparison to our Federal standard.

I know it is not quite as flexible, but I have no way of going into that arena as a U.S. technical representative and saying it is not good enough or good enough for transactions up to *x* dollars, without the technical backing.

Mr. **Brown**. Do you have any insight on this, Mr. Ross, in your role on the panel?

Mr. **Ross**. Not particularly. It is a very specialized area and one of extreme sensitivity and importance. I would merely concur in the view that it is a function that if any place in Government can and will try to solve it, it is the ICST. NSA might be able to solve it, but their whole charter and view goes counter to the needs that are expressed here. The only game in town will turn out to be ICST, and they certainly are qualified to address it having originally processed the DES standard that is the American ANSI standard, as well as a government standard.

Mr. **Brown**. I am not trying to get beyond the area of this subcommittee's concern which is the Institute and its role, but I want to be fairly clear as to that role and how it relates to the work going on in other areas.

Mr. Ross. It would be highly appropriate as a subject.

Mr. **Brown**. Dr. Henderson, do you have any comments on this?

Dr. **Henderson**. I am not involved in the particular area of encryption. I would make one note, though.

Many of the kinds of efforts that we are talking about here require very extensive commitment over a long period of time. For example, the standards efforts on the open systems interconnect model for wide area networks has involved negotiations for a number of years all over the world, and one of my concerns is that if you don't have a focal point that is willing to make that commitment over a long period of time, attend all those meetings, in some cases the mere fact that you are not at a meeting removes you from being a party to any subsequent negotiations.

So while that might not be particularly relevant to the encryption area, I think in general, one of the roles that ICST provides is some kind of ongoing commitment with a history and a memory and a long-term goal, and would not be as likely to fade away at a critical moment when tough decisions had to be made.

Mr. **Brown**. Well, in general, the subject of privacy as it applies to computers, both data and the communication of that data, is a matter of high priority in the Congress. If they have taken an interest in anything in this area, it is the privacy issue, and I don't know how—I assume that in State government, you want a certain level of privacy.

For example, you wouldn't want California to find out how many oranges you are shipping or something like that.

Dr. **Henderson**. Or Japan.

Mr. **Brown**. You would want certain standards to protect that level of privacy suitable to your needs.

Dr. **Henderson**. One of the founding factors that I see, and I will leave it to a real policymaker to elaborate, is not the issue of, is the potential of security being used as a reason why you cannot share resources.

I mean, a standard response that we get is, we can't use this computer. We can't network our computers and share resources and save money because, and a long technical stream follows.

One of the things ICST can do is begin to separate some of those issues for us so we find out where there is in fact a privacy concern and where there is not.

Mr. **Brown**. Mr. Ross, I observed last year the efforts to separate ICST from the Bureau, and as I recall, the first proposal was to move it over to the General Services Administration.

I presume you wouldn't think too highly of that kind of a proposal.

Mr. Ross. Well, I don't have all that much of a personal opinion to recommend. That is why we recommended a blue ribbon panel of some sort to really give such questions a study in depth.

A move to GSA, for example, would have a negative effect in that it would not be able to provide the same environment that the Bureau is so famous for of sound, scientifically based research, whereas we have full confidence in that aspect of the Bureau. That is part of the fabric of ICST and ICST is the Bureau in its field, in any case. So we think that they would carry that along with them as long as they are provided with an oversight of administrative management of a home that is fully enthused about what their program is and can give the proper stability of budgets and support.

Mr. Brown. I wish to clarify what your current proposal is which I perceive is providing the additional, substantial additional autonomy to the Institute, but under the general guidance of a high level policy group of some sort.

You also stress the activities of the Institute that go beyond just standard-setting. There are policy aspects, policy analysis aspects and other things that you referred to and you are getting fairly close to a proposal which I have incorporated in a bill which has been introduced in the last two sessions which provides for an institute for information policy and analysis.

I forget the exact title of it, but it is a free-standing institute which would deal with many of the critical issues in the emerging information field that you have described. I may want to call you to testify in support of that institute sometime.

Mr. Ross. Be glad to look at it.

Mr. Brown. Mr. Sensenbrenner?

Mr. Sensenbrenner. No questions, Mr. Chairman.

Mr. Brown. Senator Stuart, you made reference in your statement to, several references to, networks, and the importance of interconnecting the telecommunication needs, computer resources of the State with the Federal Government, and I presume with other levels of government. I wondered if you could give us some examples that would illustrate the importance that you attach to this.

What kinds of, or where is, the volume of interconnection with the Federal Government? Would you be benefited by a capability for networking with other States or with local governments? How do you perceive this revolution is affecting State government in specific terms?

Mr. Stuart. Well, the most specific way that we have used the institute standards is a pilot program called the Florida Information Resource Network, acronym FIRN, which is a pilot program to tie together the 4 or 5 large university computing centers with two separate county school systems that have a computing system, and within each of those counties, tying it to minicomputers that are in, I presume, in certain schools, and to microcomputers, which are in smaller schools.

That is a pilot program that has a lot of possibilities. Classrooms could be taken in the classroom by the teacher on the microcomputer and consolidated and transferred directly to the data base, wherever it was being kept, for example.

There are a lot of possibilities. Now, that particular project happens to tie together multivendors, and each of those data centers has a different vendor. It ties together big computers. Florida buys as big a computer as these vendors make, so we got some big ones, and some teeny ones all in one system.

The procedure adopted X.25 Protocol, an ISO standard. It uses a technology that will, in fact, tie together multivendors, and it will work. The bureaucrat's position to us always is, it really won't work. It really won't work in transportation, for example, because we have to deal with the Federal highways. They are always for it in everybody else's agency except their own.

We could not get across the hurdle of whether you can tie together large systems with this pilot program unless there was a standard we could adopt.

Education happens to be the place we have started, because our evidence is that 40 percent of the computing money in Florida is spent in the university systems, and another, I guess 5 to 10 percent is spent, State money, that is, in the Department of Education, so the combination of K-through-12, and the university system, is probably 50 percent of the dollars in Florida and big machines.

We have a system in Florida where there are limited computing centers for the universities. The idea was it would be one or two or three. It has actually grown to four or five or six. The University of Florida does computing for several universities.

That is the most specific experience we have; it could not have been done unless we had some independent source that had the technology to give us a mutually adopted standard. Had we tried to say everybody was going to hook up to the IBM, the CDC computer at FSU would have gone bananas. We were able to go to a single standard.

Mr. BROWN. Gentlemen, I think you know this subcommittee has had an interest for a number of years in the changes, technological changes being brought about by the computer and telecommunication revolution, and it is hard for me to continue to focus just on ICST without thinking in broader terms which we have wandered into here occasionally, but I assure you that it is relevant to our overall concern, and I very much appreciate the contribution that you have made.

Mr. Ross, it will take me a while to absorb all of your contribution, but I am going to try to get through it.

Mr. ROSS. I am sure you will, sir. One last thought which did not get into my notes to myself for this morning, namely, as we heard yesterday in some testimony from the Bureau people, the Department of Commerce has just started today on a 30-day study of what to do with various things in this area, including ICST. It is my fervent hope that that activity will help to focus our upcoming evaluation panel meeting that I will chair. I hope also that that study can be tracked well by both your committee and the Senate committee. I am always an optimist—software people are always optimists—but I am hoping that that may provide on the administration side some of the complementary starting views at least for the very seriously considered proposals of our Evaluation Panel. I hope that some really good, long-term things can come from this year.

Mr. BROWN. We will watch that very carefully. As you know, one of the problems that we have right now is that there seems to be a lack of centralized policy direction within this. There is no reason why NTIA should not be a policy-making head. It is charged with high-level policy responsibilities.

On the other hand, it overlaps there with FCC, which also is charged with high-level policy responsibilities.

Unfortunately, there is another focus in OMB, which under the Brooks Act and the Paperwork Reduction Act is charged with considerable government-wide responsibility.

It would appear to me that it is time for the administration to get its act together, and to coordinate all of these into one policy apparatus and not throw the Institute out because they don't have a government-wide policy at the present time.

Is that the kind of thinking an anathema to you?

Mr. ROSS. It is along the lines of what we were proposing last year and this year; namely, for all sorts of good housekeeping reasons, the ICST should continue to be housed in its current quarters at the Bureau, while this whole matter is given very careful study. I am naive in these things, and I am completely apolitical and don't understand how any of this machinery runs in the hallowed halls of government, but I am very impressed by the job done.

So, the conclusion that I come to is that if the Congress, itself, the nonexecutive branch of government, can use this opportunity, and this year, to say, let's put a stop to having the administrative component that currently houses ICST propose continually disastrously low budgets for good reasons—see, I understand NBS. I deal with many business environments through consulting. I see, in fact, places that have a scientific and engineering history now confronted with the rapid changes and strangeness of software, computers, communication. When push-comes-to-shove, these management organizations and the people that make them up naturally shift to protecting what they, themselves, feel and understand.

That is what has been going on at NBS.

Things were going fine as long as the budget crunch was not there, but as soon as the budget pressure comes, of course, they have to be protecting the larger laboratories for which they feel a closer affinity.

Dr. Ambler is a fine man in his job, a scientist of wide reputation, and a science administrator of broad experience. He also has been causing a lot of this grief recently, under this pressure of how to maintain what he really recognizes as his primary charter with this strange beast, ICST, still under his wing.

That can greatly be clarified if the Congress—I keep stressing that, says to the Administration: This is a watershed year, we are ready to make that commitment. We don't know exactly what to do yet, but we will make the legislation to make it happen, and for this year leave ICST where they are, give them the money, give them the slots, make sure it is spent, and that will make enough of a focal point to resolve these things with a proper careful study, and I am sure the National Research Council would be happy to help staff such studies, if that is appropriate.

There are lots of resources in this country. Let's do the right job this time.

Mr. STUART. I might also point out that your legislation for an information policy, it is an idea that we are trying to implement in Florida this year.

The bill we filed as a result of our committee calls for an information resource commission which is made up in the State of Florida, made up by the top policymakers in Florida, being the Governor and cabinet of Florida, to try to put in one location—exactly the problem you have at the Federal Government now, that you know, people doing the communications side say that is our business, somebody else doing the processing side says it is our business, and it really is the business of top policymakers.

If I have learned anything as a layman in this field, it is that when the policymakers get down to making the final decision, there is no decision for them to make. It has already been made by technicians and other bureaucrats, and it was made 1 or 2 or 3 years earlier, and there is really nothing you can do about it now. We found that in the legislature, and I am sure the executive branch of Florida finds that out.

I am sure the top policymakers in the Federal branch do. When the decision finally gets to them, the contracts have been signed. The funding has already been done. There are no options. We think there ought to be a centralized location where top policymakers can examine options before they become a budget issue, and before they become a contract negotiation, or before they become a bid, or whatever the procedure is, and we are, it seems to me, from what I have heard you describing about an institute for information policy, we are following your lead and not having seen your bill yet, we are fortunate that we may have ours passed in the next couple of months, and we will certainly send you a copy of it.

I think you have had a good idea. We have stumbled upon it. It is obviously a very good idea.

Mr. Brown. We will be glad to exchange legislation with you.

You have made a very good point here, that in the society, future decisions are going to be made by those who control information. Probably it is the bureaucrats now who are controlling the information, but I would like to see some policymakers have some control over that information, and be able to establish policies in the usual political way.

It is always good, of course.

Mr. Stuart. Absolutely, and we see a third-party expert who can cut away all the stuff and say technically give us a technical opinion that you can do this; yes, you can connect these two computers; you can have a secure system; and all of that can be a technical issue, and then the policy issue can be made by policymakers: Do we want to tie the criminal justice computer and the revenue computer together? Is that a good policy?

We will have a third party saying it is possible or not possible.

A technician now makes the decision of whether it is possible or not, and the policymaker is really a slave to his technicians.

That is what we are trying to get across.

Mr. Brown. Gentlemen, I would like to discuss this with you at much greater length, but I have a responsibility to keep on schedule here, so let me thank you very much for your excellent testimony, and we will try and take advantage of the advice that you have offered in handling this matter.

Thank you very much.

Our next panel is Dr. Howard W. Emmons, professor of mechanical engineering at Harvard, and Mr. Arthur C. Delibert, president, Citizens Committee for Fire Protection, Washington, D.C.

Each of you may present your statement.

Would you like to begin, Dr. Emmons?

[A biographical sketch of Dr. Emmons follows:]

Biographical Sketch

Howard W. Emmons

I was born August 30, 1912 in Morristown, New Jersey, was educated in the local public schools and then graduated as a Mechanical Engineer from Stevens Institute of Technology with an ME in 1933 and MS in 1935. I then obtained an ScD degree from Harvard University in 1938. My entire education was obtained on scholarships.

Following graduation, I was employed on steam turbine research at Westinghouse (two years) followed by teaching and research one year at the University of Pennsylvania, then at Harvard from 1940 to date.

My teaching has always been accompanied by research and consulting. During WWII I carried out aircraft gas turbine compressor research for Pratt & Whitney Aircraft and advised Aberdeen Proving Ground on the design and construction of its first supersonic wind tunnel. I served on many military advisory committees and NACA (now NASA) compressor committees.

In 1956 I was asked to join the new Fire Research Committee of the National Academy of Science. This work continued until about 1970. From 1958 until 1970 I was a member of the Space Science and Technology panel of P.S.A.C.

In 1962, I chaired a N.A.S. sponsored Summer Study on Fire Research at Woods Hole, Massachusetts which recommended a federal program in fire research as the only practical way to enlarge the very weak scientific base of fire safety design. I have served on many fire related committees, local, state, and national since that time.

In 1966-67, I took a sabbatical leave and visited all the major fire research laboratories everywhere around the world.

During the past 10 years, I have served as technical expert on a number of fire litigation cases including the Beverly Hills Supper Club Fire and the MGM.

In 1982, I was awarded the Man of the Year award of the Society of Fire Protection Engineers

From 1950 to date, I have carried on combustion research at Harvard, educating some 30 Ph.D. candidates in fire dynamics, sponsored variously by U.S. Army, N.S.F. and N.B.S.

Most recently, I was a member of the Products Research Committee which sponsored fire research on cellular plastics with $5,000,000 from the plastics industry as a settlement of an F.T.C. class action suit.

STATEMENT OF DR. HOWARD EMMONS, PROFESSOR OF MECHANICAL ENGINEERING, HARVARD UNIVERSITY, CAMBRIDGE, MASS.

Dr. **EMMONS**. My thesis is quite simple. I have been a professor at Harvard for many years and have been engaged in fire research at a technical level and have trained many students who similarly in many cases are working in the fire research area.

Included in that effort over the past 30 years or so has been a study of fire department operations, the design of buildings from the fire safety point of view, a study of fire procedures around the world, and I am horrified to see the proposal that you cut one leg out from under a three-legged stool. You can sit on a two-legged stool, but it is not very stable.

This is what is happening, if you cut out the effort in the development of facts and knowledge of fire being developed at the Bureau of Standards.

What is our procedure for attaining our current level of fire safety?

Goodness knows, our current level of fire safety is not very good.

All you have to do is turn on the TV, and you find another fire or fires and further life lost.

There must be something wrong with what we are doing.

What are our procedures? Well, we are all familiar with the local fire departments. A municipal operation, and pretty much it should be.

Municipalities are very large in number. They are small units. They are quite proper for the extinguishment services and the preventive services that they render to the municipality because they have the basic information at their hands to make the decisions.

At the State level, there are efforts appropriate to the various States.

With respect to the operation of firemen training schools, the adoption of State codes, but they are not in position to do anything with respect to increasing our knowledge of what a fire does, why it does it, how it does it, and, therefore, they are not in position to mount a research program which permits us to make progress in our attack on the problem.

There is the industrial side. The design of our fire safety is carried out by architects and engineers. These are small independent units competing financially.

It is their duty to be sure that the building that is designed and built follows the relevant local building codes, the local fire codes of the municipality, and/or the State, as the case may be.

It is not their responsibility to decide that those codes are or are not adequate.

The actual fire problem, of course, is sometimes present because of the fact that the codes were not followed, and we can point out deficiencies.

On the other hand, very frequently a serious fire occurs and a technical examination says, gee, I don't know why that happened.

In the MGM, for example, the ceiling material in that building passed a fire spread rating of 20 on our tunnel test that we use in this country, and yet the fire raced 500 feet across the casino in 2 or 3 minutes. How did it do this? We don't know.

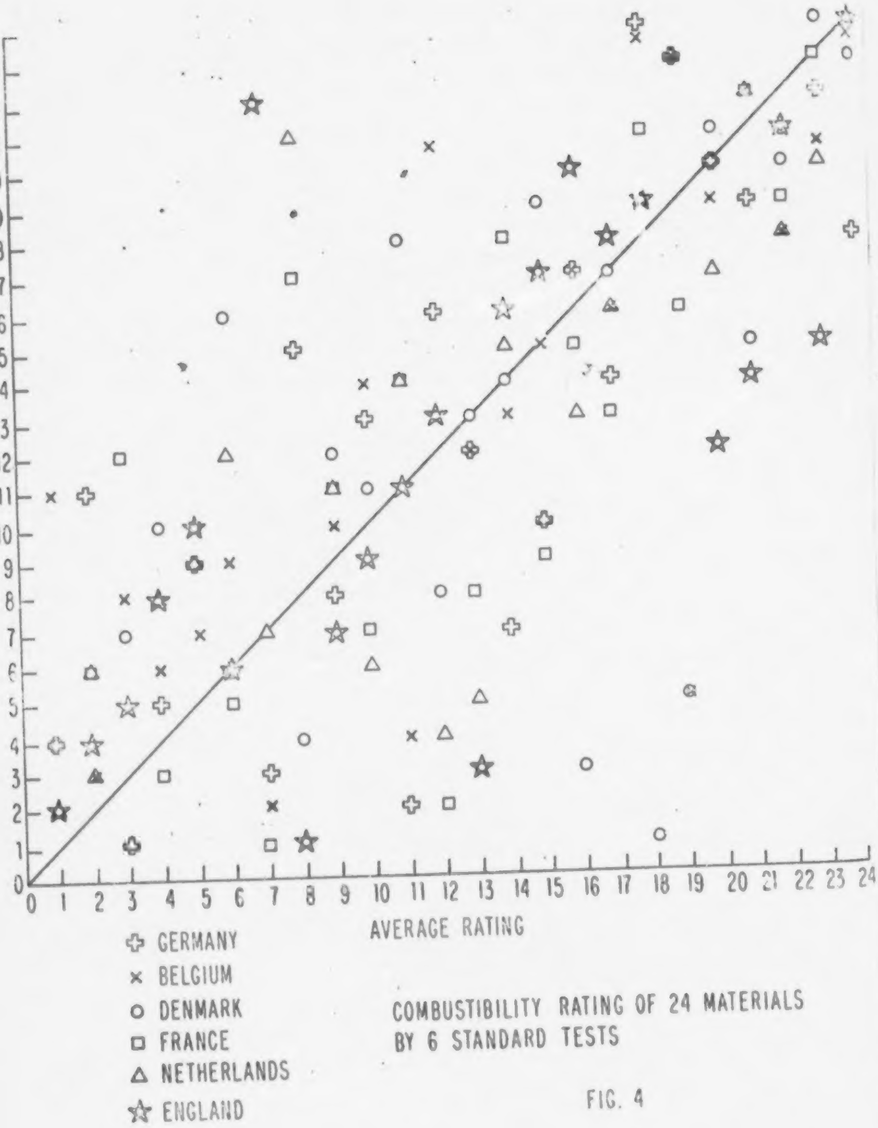
You cannot make major improvements to a situation where there is a lack of knowledge of the basic phenomena that are occurring.

Well, that is not quite correct. Evolution has accomplished an enormous amount. We are here, we got here from amoeba.

The current fire procedures got here over the last several hundred years through accumulated experience largely, but, my, that is much too slow. We have a much better way of proceeding. Evolution is now speeded up by what we call applied science, and it is that leg of the stool that is being supported by the effort at the Bureau of Standards.

Let me point out the deficiency that currently exists in the—I want to call your attention to my little graph, the top page, labeled "Fig. 4".

[Fig. 4 follows:]



COMBUSTIBILITY RATING OF 24 MATERIALS BY 6 STANDARD TESTS

FIG. 4

The page is full of shots as though it was made by a shotgun. Each country has their own standard test.

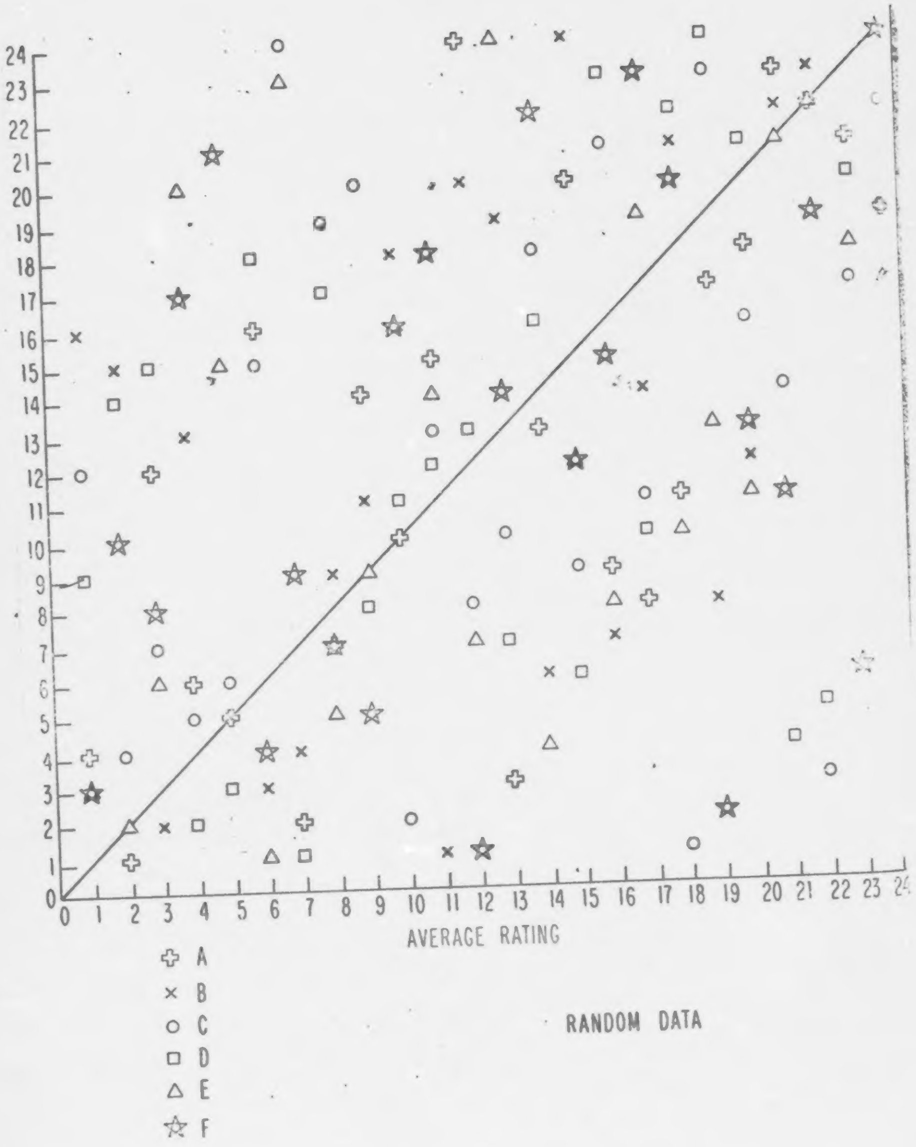
Twenty-four wall-covering materials were tested for flammability. In each of the major laboratories in the six countries of Europe that are noted there at the bottom, and these are the flammability requirements tests that in cities in those countries decide whether a material may or may not be used.

These 24 materials were tested by all six countries, and each country put them in order of flammability, the most flammable and the least flammable, and an order in between. If they all decided, if all these tests gave the same order, you would have had a single straight line across the page, and, as you can see, they are not very good. In fact, material No. 18 is particularly interesting. It is the best of all 24 in Germany, and it is the worst of all 24 in Denmark.

Do we understand how to test for flammability? No, we do not, and until such a basic item is understood and can be used in the design of our structures and put into the building codes appropriately, we cannot expect to have a consistent degree of fire safety.

You might turn the page over and look at the spot diagram on the next page, "Fig. 5". It is a little worse. That is 24 numbers put in a hat and pulled out 4 times; 6 times—sorry—and presented in the same way. It is clearly worse but not much.

[Fig. 5 follows:]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AVERAGE RATING
✠ A
× B
○ C
□ D
△ E
☆ F

RANDOM DATA

How are we going to fix this? We are going to fix this by learning what a fire does, why it does it, how it does it.

Then we will work that knowledge into our city codes, State codes, national codes, as the case may be.

Who should do this research? Municipalities? The unit is far too small. They could not conceivably afford the considerable facilities, the extensive instrumentation, the high-level staff required to carry out a research project of this sort.

States? Well, some States are as large as some countries that do, but it is a pretty small program and in any case in the United States it would be ridiculous to have 50 or so independent research laboratories working in the fire area. There would be enormous duplication, a terrible waste of money and a waste of manpower and facilities.

There is only one way that could be done, so far as governmental procedures are concerned, and that is Federal.

How about industry? Why shouldn't industry do it?

The industry involved in supplying the materials for which this and other buildings are made of are required to supply materials which, when the architect, the engineer specifies them for the building, that they will indeed satisfy the local building codes.

Industry is under no obligation to find out whether the codes are correct, and, in fact, in general, they could not afford to mount a major program attempting to do this.

Fire insurance industry: I have often been treated with skepticism when I mention the fact that the fire insurance industry has not mounted a great fire research program. In fact, the fire insurance industry stopped the Fire Research and Safety Act of 1964 in congressional committee by a barrage of telegrams and letters. Why should they be taking a position like that?

Well, look at the situation. They are in business like evereyone else, to earn a living. Suppose they did mount a research program—and unlikely—but supposing they did have a breakthrough that eliminated the fire problem; we would not need fire insurance. They have done themselves out of business. Why should they do major work in fire research?

It so happens that the Factory Mutual System does. They are an industrial fire insurance industry, and I understand Mr. Rhodes was here. Why do they do it? Because that is a mutual company. Those who are insured, the industries that are, are the owners of that company, and they are, therefore, helping themselves.

No, there is only one possible way that we can fill in the required knowledge, and that is through the continuation and even improvement in the effort at the Bureau of Standards. It is a very fine program. They have designed a 5-year program. They continually reexamine what their effort can provide. They take part on the various committees that provide for the development of codes and standards.

They are in process of supporting the effort to make it possible to do in fire what is being done in other fields of engineering, namely, when you design something, you calculate the performance and set the design so as to get the guaranteed performance, and this is a mathematical question which in other areas can be carried out on a slide rule or small computer, but in the fire area, it takes a modern computer to carry out the work because it is so complex.

Let me give you one illustration of where I think the future of fire safety design is to be.

The city fire codes currently are specification codes. In this country you must usually pass, your material must pass, the tunnel test with a ceretain flame-spread rating. In other countries it must pass another test, not necessarily in agreement.

You must have corridors that are 6 feet wide, this and that, specified.

They are not performance codes. They ought to be performance codes. I don't care what the flame-spread of a material is in a flame test tunnel. I don't work in a flame-test tunnel, and I don't live in a flame-test tunnel.

I live in a house, and I want to know what the flame-spread is going to be at the house, not in the tunnel, and if the tunnel is a proper measure, fine. We have pretty good evidence that it is not.

We must be able to take the design of the building, imagine that a fire is started over there, and calculate what will happen, and when we can do that, we can write a performance code. I would propose that the code say no matter where or when the fire starts in this new building, everyone can get out no matter where they are.

Why don't we write that now? It is easy. We don't know how to find out.

When we do learn what fire does and how it does it, we will be able to put a computer program in the city computer and the architect brings his design to the city, runs it through the computer, and the computer says, everybody can get out or, sorry, those who are up there can't get out if a fire starts over there. Go back and fix it.

We can have a performance code someday, after some organization supports the development of such a program. Why don't we have that program already? Two reasons: It has not been worked on long enough to have produced it all.

In the second place, there are certain things we just don't understand and the Bureau of Standards is providing some of that information, as to how to go about making such a program.

Second, we do not yet have information on how the large number of different materials, the large number of different structures of chairs and tables and furnishings behave in fire. We need test data, some standard tests designd to produce the information needed with the calculator code that I mentioned.

Again, the Bureau of Standards is taking initial steps in that direction. There is much work to be done; and to cut that leg out from under the stool is the height of folly, in my view.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Emmons follows:]

Statement on the Mission of the Center for Fire Research

National Bureau of Standards

H. W. Emmons

March 1, 1983

It is obvious just by listening to the news almost any day that our fire safety system does not work very well. There must be a better way to assure the fire safety of the public. We can identify essential parts of the urban fire problem: the design of our built environment, the materials from which we build it, the potential ignition sources, the detection and alarm systems, the extinguishment services. What can be done in each of these areas at any given time depends upon man's knowledge of fire and its behavior.

The spectacular part of the fire problem is the firemen racing to answer a fire alarm, attempting rescues, laying their hoses and attempting to quell the flames issuing from the windows and roof of some building. They are indeed heroic men engaged in one of the most dangerous of occupations. In a sense, their efforts are "locking the barn after the horse has been stolen". The fire should not have occurred in the first place.

The fire extinguishment services, the fire departments, are local municipal services. This size unit is not too small for fire extinguishment, especially when there are cooperative agreements between adjacent towns (as there usually, but not always, are). These units can make the necessary decisions with full knowledge of the local circumstances. However, as a consequence, there are many thousands of independent units. The fire services also often do fire prevention work in their own municipalities.

The design of buildings for fire safety is the responsibility of the architect and engineer. They carry out their process of fire safety design by reference to the relevant fire codes of the city and state in which the building is to be built. The codes specify a variety of things found by experience to be important for fire safety, e.g. corridors must be eight feet wide, there must be two routes of egress, etc. Furthermore, the materials from which a building may be made must pass various fire tests with specified ratings.

While architects and engineers have their professional organizations, they are essentially independent entrepreneurs earning their living through competitive bidding on design jobs as they become available. Fire safety of building design is a private enterprise effort guided by fire codes.

The materials from which the architects and engineers might choose to build their buildings are supplied by various competing industries. Each industry, to sell its wares, must show that its material passes the fire tests specified by the city fire code where the building is to be built. Furthermore, since price is important, they will attempt to make the cheapest possible product consistent with its minimum use requirements. Industry pays for the material development, and for the required fire tests. This is as it should be since the competition helps to assure the public of a variety of products to choose from.

All of these essential steps of fire safety are municipal, state or industrial responsibilities and are indeed well carried out (in general) at their respective level. Why then do we have so many bad fires and where does the federal government come in?

I have said at several points that fire safety is presumably assured by the city fire codes both in stating what the architect-engineer may and may not do and in selecting tests which the building materials must pass. In fact, the codes as they exist today do not assure us of the level of fire safety of our buildings that we desire.

Why? Because our fire codes are specification codes, not performance codes. The codes should require that everyone in the new building will be able to get out safely no matter where or when a fire starts. This could be accomplished by codes containing the proper specifications of design rules and materials tests or even better by simply demanding assured safe egress for everyone when a fire starts.

Why don't we fix the codes? Because we don't yet know how! The available fire codes are developed by committee consensus on the basis of the best information and experience of its members. Such committees have no significant research budget. When they meet a problem for which the available information is inadequate, they try to get some small research done somewhere, and then with or without the research they discuss and vote. The improvement in the fire codes has been primarily by evolution through fire experience. Evolution by experience is a very powerful force. Man has evolved after billions of years. The present level of fire safety has evolved over the past several hundred years. Evolution is great, but slow.

Man has learned how to speed up evolution. It is called Applied Science. In fact, urban fire safety has increased more and more rapidly in recent years through the adoption of accumulating scientific knowledge of our complex world. Many of the improvements (e.g. better fire engines) have resulted from a transfer to fire purposes of developments in other areas.

Where is the applied science research specifically related to fire being done? Where should it be done? For forest fires, the answers are clear. Because of the large public forests, national parks and wildlife areas, the large number of unorganized private forests, and the long and successful history of the Agriculture Department, the U. S. Forest Service carries out significant forest fire research in three national forest fire research stations at Macon, Georgia, Riverside, California, and Missoula, Montana. The forest fire research requires wind tunnels and applied research via aircraft.

The urban fire problem is different. Here the fire in a room and the room in a building are basic. The materials of construction vary from concrete to unfireretarded polymers and liquid hydrocarbon fuels. The research facilities needed are rooms and room combinations in which fire experiments can be performed. Extensive, sophisticated chemical, optical, and physical instrumentation is essential. Biological and physiological facilities of a rapidly growing complexity are needed to develop the required knowledge of fire related toxicology. The research analysis requires computer capability which is just beginning to be great enough to solve complex fire flows.

Such research facilities are both extensive and expensive and can only be efficiently operated by a team which includes specialists in dynamics, chemistry, physics, and toxicology.

How is such research to be done? Whose problem is it?

1. Should municipalities do it? No city could afford it. A few cities around the world have what they call "Municipal Fire Research Laboratories". The most notable is the one in Tokyo. Where they do exist they are not studying the basic science of fire. They are primarily engaged in proof testing of purchased fire department equipment and the development of solutions to specific fire department problems.

No! Municipalities cannot do the required work. They are individually too small a unit and are not and will not be organized nationally to act together.

2. Should states do it? They could. Some states are as large as some countries which do. However, we should consider the efficiency of this approach. The forest fire problems in the southeast, the southwest, and the northwest are sufficiently different to merit three forest fire research laboratories. The urban fire problem varies only slightly from one part of the country to another. To have 50 urban fire research laboratories would mean needless and wasteful facilities and effort duplication.

States can and do operate fireman training centers. States cannot operate efficient fire research laboratories.

3. Should industry do it? It could but why should it?

Architects and engineers will slowly continue to improve fire safety design practices by experience. However, their job is the design of a building for the desired purpose at the lowest possible cost consistent with the existing city fire codes. It is not their problem to question the adequacy of the codes nor can they afford to finance the basic studies required to improve them.

The materials industries likewise are concerned with existing fire codes from the point of view of getting their materials through the specified tests. Their sales and profits require the cheapest possible product which will satisfy the intended construction market (building, furniture, furnishings) and satisfy the codes. It is not the direct responsibility of industry to concern itself with the adequacy of the codes to provide public fire safety.

In fact, we know how to make a really fire safe building - make it entirely of reinforced concrete. But we don't want to sit on concrete chairs in such austere surroundings. Thus a fire code is necessarily a compromise between complete fire safety and comfort, convenience, and aesthetics. Industry can and often does have a different view of the best code compromise. It is often true that to relax a fire code would permit the manufacture and sale of a cheaper product. Thus the public would be served financially at the cost of increased fire risk. Industry does do bits of fire research where it will be of direct advantage to its product and sales position. This work is rarely of fundamental character and it is nonsense to expect industry to spend its profits attempting to improve public fire safety through improvements in the codes, test methods, toxicological knowledge, etc. Industry does not, will not, and cannot be expected to finance the required fire research.

4. Should the fire insurance industry do it? I find that most people expect that they do and are amazed when they learn that the fire insurance industry was responsible in an important way for the defeat, in congressional committee, of the Fire Research and Safety Act of 1964. In fact, one of the best industrial fire research laboratories in the world is operated by the Factory Mutual Insurance System in Norwood, Massachusetts. Their effort is small compared to the magnitude of the fire problem and their concern is for protection of industrial properties - not homes and people.

The insurance industry does have a concern for fire safety. Many years ago they started the Underwriters Laboratories to test and approve (UL label) products which meet various safety standards. This laboratory does an excellent job of testing and checkup on product safety according to existing standards and for products voluntarily brought to them for test. The insurance industry started the Underwriters Lab but they no longer support it. It operates entirely on test fees. Thus the Laboratory has no basic fire research program and participates with only a modest effort in test improvement.

If fire research were to attain a breakthrough and fire ceased to be a significant problem, we could all dispense with our fire insurance. What kind of an incentive does this provide to the fire insurance industry where super success in research would mean the end of their business? No! The fire insurance industry will not and cannot be expected to support the required fire research. (The Factory Mutual system does have an incentive to eliminate fire since indirectly the industrial "owners" of FM are protecting themselves.)

Fire research is a national problem and must be supported in its basic and public safety aspects by a federal program. The federal level is the only level at which the public incentives and the efficiency is even close to what is necessary to carry out the long range studies required to improve our fire safety. The Center for Fire Research at the National Bureau of Standards has developed a program of fire studies directed toward an eventual understanding of fire in our built environment adequate to provide the fire safety compromises which the public deserves. They already participate in the code making processes both by supplying basic data and by membership of many Center for Fire Research personnel on code development committees.

The Center for Fire Research at NBS is the only laboratory with the facilities and staff required for this work. They have a well planned program which is making continuous progress on our understanding of and practical progress with fire safety and, with continuity, will supply the ultimate level of fire safety which compromises all of society's desires.

Let me close with an illustration of what I regard as one of the roads to ultimate fire safety. At present, as I noted before, fire codes are specification codes, they specify building requirements and tests for materials (e.g. a 25 flame spread rating in the tunnel test). We must one day replace such codes with performance codes so everyone can get safely out of a building no matter where or when a fire starts. This, among other things, is what we really want. We really don't care what the flame spread rating of a material is. We don't live or work in a fire test tunnel.

Why don't we adopt a performance code now? Because we don't know how to find out if a given building would satisfy such a code except by building it and burning it down (many times with different fire ignitions).

A performance code cannot be practical until we can predict quantitatively how a fire grows, when the detection system warns the occupants of impending danger and when all the escape routes become untenable because of high temperature or toxic gases. The computer is now big and fast enough to make such predictions possible. It has not been done because:

1. A number of fire phenomena are not yet adequately understood.
2. The required fundamental test data on materials and items of furniture have not yet been adequately measured and assembled into a handbook of basic thermal and chemical fire properties.

The Center for Fire Research at the National Bureau of Standards is supporting work in all of the required areas. They are supporting the development of the computer fire computation both in-house and by contract; they are carrying out studies of the basic fire phenomena not yet adequately understood; and they are developing test methods by which the fire and toxicological properties of materials can be measured. Once the test methods are developed, industry can be expected to pay for the testing of its products and thus indirectly contribute to the assembly of the required handbook.

It is an expression of ignorance to believe that the fire studies required to solve society's fire problem will or can be undertaken in any comprehensive way by industry, state, or municipal governments. As a consequence, it is insane to discontinue the work of the Center for Fire Research at the National Bureau of Standards.

Summary of Pertinent Qualifications

Howard W. Emmons

1. Member of the Fire Research Committee, National Academy of Sciences, 1956-1972
2. Chairman of N.A.S. - Summer Study on Fire Research, 1962
3. Help the Factory Mutual Engineering Laboratory establish their fire research program and continue as consultant on that program, 1965 - date
4. Visited Fire Research Laboratories around the world, 1966-67
5. Chairman, National Bureau of Standards Fire Research Evaluation Panel, 1971-1976
6. Chairman, Fire Protection Committee, Harvard University, 1974-1979
7. Member "Products Research Committee", 1974-1980. This committee, established as a result of an FTT class action suit against the plastics industry, was appointed to sponsor fire research on cellular plastics with five million dollars over five years.
8. Chairman of the N.A.S. evaluation panel for the National Engineering Laboratory of the N.B.S.
9. Member of U.S. - Japan Joint Committee on Fire Research, 1977 - date
10. Chosen "Man of the Year" by the Society of Fire Protection Engineers, 1982

Mr. **Brown.** I think you made your fundamental points very, very clearly. We need more and better research, and there is not any other place to get it done.

I could ask you why Harvard has not done it.

Dr. **Emmons.** Simple.

Mr. **Brown.** I will note that you contributed to the solution of the problem not only through your long career in this field, but helping set up the research program at the insurance company that you mentioned, and I suppose that that sort of thing was in the back of the mind of the people at the Office of Management and Budget, when they cut this out, that possibly through, in some way or other, other insurance companies might pool their resources or other industries involved in this might pool their resources, and I would have no objections to that, if there was any indication that they actually would do that, but I would prefer to see some evidence of that fact before we destroy what we have.

Mr. Delibert, you may proceed.

STATEMENT OF ARTHUR DELIBERT, PRESIDENT, CITIZENS COMMITTEE FOR FIRE PROTECTION, WASHINGTON, D.C.

Mr. **Delibert.** I am Arthur Delibert, president of the Citizens Committee for Fire Protection.

The Citizens Committee is a nonprofit research and advocacy group dedicated to reducing the terrible toll of death and destruction caused by fire.

We are opposed to elimination of the Center for Fire Research. CFR is a critically important center for basic and applied research in fire and fire protection. It is unequalled in the Nation, and, once lost, could not easily be replaced, either in Government or outside of it.

The Center's direct contribution to fire protection, through its own research, and its indirect contribution through the work it sponsors, have saved this Nation amounts that far exceed the few million dollars the agency spends every year. Two areas of CFR work that come readily to mind are smoke detectors and children's sleepwear. Both rank among the outstanding fire safety success stories of the past decade. Neither would have come about when it did had it not been for the Center's work.

If you want to do a little shirt-sleeve cost-benefit analysis, look at a few personal injury and death judgments that run probably in the range of half a million or a million dollars and think how many fires it would take before the whole budget of the Center for Fire Research is right there in lost resources, 5 or 10.

The administration says that the Center's work could be done just as well by private industry. This is simply not true.

The fact is that some of the most important research done at CFR has been offensive to some in private industry. In October 1981, for example, the Center published a report suggesting that there are considerable differences among the various brands of cigarettes in their tendency to ignite common upholstery fabrics.

This is enormously important. Cigarettes are the cause of more than one-third of America's residential fire deaths. In most of these fires, the first items ignited are mattresses, bedding, or upholstered furniture. The Consumer Product Safety Commission and the furniture industry in recent years have devoted considerable resources to curtailing this problem by changing the way furniture is made.

The Center's work points toward an entirely different way to prevent these fires: Change the way cigarettes are made. Your colleague, Representative Moakley of Massachusetts, has introduced a bill that would mandate further exploration and development of this important idea. Just 2 days ago, the Subcommittee on Health and Environment held a hearing on this bill.

Can anyone seriously imagine the cigarette industry conducting this same research? Would the results be readily available to committees of the Congress and to the general public? We doubt it very much.

Another example: Last year, the Center published a test protocol for measuring the relative toxicity of various materials. Toxicity is a hotly contested issue nowadays between the plastics industry and its competitors. Hardly anyone needs to be reminded of that.

It is strongly suspected that certain plastics, when they burn, create new and very serious toxic hazards. Fire and building officials across the Nation are desperately in need of reliable means to compare the fire toxicity of common materials.

Here again, can we really imagine the plastics industry going about this work with the same attitude and enthusiasm as did the Center for Fire Research? Would we all be comfortable making major policy decisions about building safety based solely on the industry's test results or the results of its competitors? Again, we doubt it very much.

This Nation needs a fire laboratory whose outlook is as neutral as we can achieve, and those policies, processes and results are open to public scrutiny. Private industry cannot do this job.

Mr. Chairman, all of this leads us to a very troubling question: If the administration's alleged reason for eliminating CFR is not true, then what is the real reason?

We find ourselves wondering whether CFR is targeted for elimination precisely because it has offended some major private industries.

We don't raise this issue lightly. But in recent months we have witnessed a sad spectacle at the Environmental Protection Agency. We have learned about public officials who saw the business community as their major constituency and who attempted to steer their agency so as not to offend that constituency. And we have heard about "hit lists" of respected scientists, who were slated to lose their positions because good science, apparently, was not enough for some people.

We intend to pursue the question of why CFR was targeted for elimination. We have recently filed Freedom of Information requests with the National Bureau of Standards, the Department of Commerce, and OMB for all documents and correspondence related to the budget and elimination of the CFR. We will be glad to share the results of this request with the committee.

We recommend, however, that you conduct your own inquiry into the reasons CFR was targeted for elimination. Your resources and your powers of inquiry are far greater than ours.

This question of why they were targeted has important implications for the future. If the administration is trying to eliminate CFR for political reasons, and if it does not succeed, then it may next try to influence the Center's scientific integrity.

Those of us for whom fire safety is a passion—and I include this distinguished committee in that group—cannot let that happen.

Thank you.

[The prepared statement of Mr. Delibert follows:]

CITIZENS COMMITTEE FOR FIRE PROTECTION
A Non-profit Corporation Working in the Public Interest

DESTRUCTION OF THE CENTER FOR FIRE RESEARCH:
TESTIMONY OF ARTHUR DELIBERT BEFORE THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY,
MARCH 22, 1983

Good afternoon, Mr. Chairman and members of the Committee. I am Arthur Delibert, President of the Citizens Committee for Fire Protection. The Citizens Committee is a non-profit research and advocacy group dedicated to reducing the terrible toll of death and destruction caused by fire.

We are opposed to elimination of the Center for Fire Research. CFR is a critically important center for basic and applied research in fire and fire protection. It is unequalled in the Nation and, once lost, could not easily be replaced, either in government or outside of it.

The Center's direct contribution to fire protection, through its own research, and its indirect contribution through the work it sponsors, have saved this Nation amounts that far exceed the few million dollars the agency spends every year. Two areas of CFR work that come readily to mind are smoke detectors and children's sleepwear. Both rank among the outstanding fire safety success stories of the past decade. Neither would have come about when it did had it not been for the Center's work.

The Administration says that the Center's work could be done just as well by private industry. This is simply not true.

2000 P Street N.W., Suite 607, Washington, D.C. 20036 (202) 466-6060

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This is enormously important. Cigarettes are the cause of more than one-third of America's residential fire deaths. In most of these fires, the first items ignited are mattresses, bedding or upholstered furniture. The Consumer Product Safety Commission and the furniture industry in recent years have devoted considerable resources to curtailing this problem by changing the way furniture is made.

The Center's work points toward an entirely different way to prevent these fires: Change the way cigarettes are made. Your colleague, Representative Moakley of Massachusetts, has introduced a bill that would mandate further exploration and development of this important idea. Just two days ago, the Subcommittee on Health and Environment held a hearing on this bill.

Can anyone seriously imagine the cigarette industry conducting this same research? Would they go about it with the same interest as did the Center for Fire Research? Would the results be readily available to Committees of the Congress and to the general public? We doubt it very much.

Another example: Last year, the Center published a test protocol for measuring the relative toxicity of various materials. Toxicity is a hotly contested issue nowadays between the plastics industry and its competitors. It is strongly suspected that certain plastics, when they burn, create new and very serious toxic hazards. Fire and building officials across the Nation are desperately in need of reliable means to compare the fire toxicity of common materials.

Here again, can we really imagine the plastics industry going about this work with the same attitude and enthusiasm as did the Center for Fire Research? Would we all be comfortable making major policy decisions about building safety based solely on the industry's test results or the results of its competitors? Again, we doubt it very much.

This Nation needs a fire laboratory whose outlook is as neutral as we can achieve, and whose policies, processes and results are open to public scrutiny. Private industry cannot do this job.

Mr. Chairman, all of this leads us to a very troubling question: If the Administration's alleged reason for eliminating CFR is not true, then what is the real reason?

We find ourselves wondering whether CFR is targeted for elimination precisely because it has offended some major private industries.

We don't raise this issue lightly. But in recent months we've witnessed a sad spectacle at the Environmental Protection Agency. We've learned about public officials who saw the business community as their major constituency and who attempted to steer their agency so as not to offend that constituency. And we've heard about "hit lists" of respected scientists, who were slated to lose their positions because good science, apparently, was not enough for some people.

We intend to pursue the question of why CFR was targeted for elimination. We have recently filed Freedom of Information requests with the National Bureau of Standards, the Department of Commerce, and OMB for all documents and correspondence related to the budget and elimination of the CFR. We will be glad to share the results of this request with the Committee.

We recommend, however, that you conduct your own inquiry into the reasons CFR was targeted for elimination. Your resources and your powers of inquiry are far greater than ours.

This question has important implications for the future. If the Administration is trying to eliminate CFR for political reasons, and if it does not succeed, then it may next try to influence the Center's scientific integrity.

Those of us for whom fire safety is a passion -- and I include this distinguished Committee in that group -- cannot let that happen.

Thank you.

Mr. BROWN. Thank you very much, Mr. Delibert.

Mr. Boehlert, do you have any questions?

Mr. BOEHLERT. I am rather curious. First of all, I think part of the reasons we don't have more colleagues here, you can explain it in a lot of ways—one is what is going on on the floor now—but second, I think there is agreement on this panel that CFR funding should continue. But I am somewhat disturbed by you raising the specter of a sinister plot within the administration. I don't really feel it is that way, and I would like to know if you have any evidence to indicate that there might be such a sinister plot.

Let me tell you what I feel.

I was in A.A. here during the Great Society years of Lyndon Johnson, and I can remember very vividly President Johnson, almost every year, would come to the Congress and suggest we eliminate the school milk program, knowing full well the Congress would never do it. But then the President would say to the American people when they talked about the need for economy, "I tried."

I'm suggesting that unless you have evidence of a sinister plot, I would tread very, very carefully in that area.

Mr. DELIBERT. I believe we are treading carefully. We raised this as a question. We think it is an important one and one we would like to put forward publicly and we would like the committee to consider it.

Mr. BOEHLERT. It is legitimate to raise questions, but the manner in which you raised it made me pause.

I remember the LBJ milk program. I think it's a good story to illustrate the point.

Mr. BROWN. That is the Washington Monument syndrome too.

Mr. BOEHLERT. Thank you for your statement.

Dr. Emmons, I appreciate all the work you have done, and while I am a newcomer to the committee and this is my first exposure to your work, I commend you for it and I feel very comfortable as I walk from this room, knowing full well what this committee is going to do.

Mr. BROWN. Thank you very much, Mr. Boehlert.

Mr. Delibert, you have made reference to the fact that there are investigations going on in other committees dealing with the proposition that you have advanced that there may be a conspiracy of some sort here.

I am not personally inclined to attribute some of the actions which you have described to a conspiracy, although they disturb me very much, and I suspect that there may be some individuals involved who are sufficiently in tune with the perceived interests of certain parts of the community that they are trying to do their bidding with this sort of thing. But I doubt if that is an administration-wide plot, and I am sure it isn't shared by the Members of Congress.

To the extent that it can be discovered, and there are some interesting things being discovered, I think that we can find that the administration and the Congress will both act to rectify it, as I think is being done—if I may say a word in defense of the administration—through the appointment of Mr. Ruckelshaus as head of the EPA.

I think that is an act of good faith and I commend them for it. However, there are some things going on in the EPA that I do not like a bit and I would like to expose them as matters of bad policy if I get the opportunity to do so, just as I will not support this elimination of the fire center.

Dr. Emmons, you painted a rather bleak picture of the scientific quality of fire research in some of our advanced countries. Did you pick the worst possible example here or do you feel in general that that is a true situation or statement of the scientific advance in this field?

Dr. EMMONS. I think it is true statement for the following reason. Let's consider the development of the airplane. A modest number of tests of aerodynamic performance of wing sections done by a couple of bicycle builders, various experiments that they could run, they put together something, they could copy a bird, they could put together partial knowledge and take their device down to Kitty Hawk and fly it or not, as they chose. Whether they thought it was ready to fly, they flew it, and when it was not, they just didn't go there at all. They did some more work first.

It is quite different from a fire. If a fire starts in this room right now, we have to do something right now. We can't say, well, I do not know quite what to do, go away, come back tomorrow, I will look it up. That means that in the area of the fire safety problem, man is immediately presented with a fact of nature that he must cope with immediately as best he can with whatever knowledge he has.

Furthermore, the fire is a phenomenon that involves complicated chemistry, air movements, more complex than for an airplane by a large factor, energy transfer—as you know, if there is a fire over there you can feel it, the radiation is serious, that is a very complex scientific problem.

There are a large number of scientific areas that are all brought together in one complex phenomenon.

Let's go to 30 years ago. I am going to be a chemist. I would like to have a nice problem to work on. Lots of chemical problems in the fire area, but if I take one look at that mess, I am not going to bother with that mess.

There are a large number of interesting organic chemical phenomena that I can work on in the area of medicine and this and that that are important and are relatively straightforward and easy compared with this mess. We have had to do something, and therefore a large group of practitioners, the fire department, the fire protection engineers did the best they could by accumulated experience.

They did not have scientific background in general. It was rare that they did. They were too busy with their day-by-day problems. In fact, the fire protection engineers, the National Fire Protection Association were vigorous opponents of that 1964 legislation for a Fire Research and Safety Act.

I have talked with all of the people there at that time because I was on the other side of that issue and argued with them. I know their point of view. Why were they against it? Because they did not realize the absence of the scientific background. They did not realize how important it was, they did not realize and are now beginning to realize what can be done if we build up a real background in fire research.

As I indicated at one point, I visited fire research areas around the world, and except in Japan and to a modest extent in Great Britain, there was almost no basic work being done. Lots of practical questions; there were obvious practical questions.

If you get a big fire as in Baltimore and the fire companies come in and can't all hook up to the hydrant because they have the wrong screw thread, it doesn't take science to understand that problem—I am not sure it is entirely fixed yet, but that is a separate issue.

The basic knowledge of physics, chemistry, aerodynamics, heat transfer, radiation transfer, have all grown tremendously during the past 20 or 30 years. And more importantly and most important, so has the computer. Twenty or 30 years ago we could have written many of the formulas, equations required to study what was going to happen in a fire, but you could only sit and look at it. You couldn't calculate anything.

A modern computer could calculate in a few seconds what would take me a year with a slide rule. So one can now take the complex pieces, put them together in a simple formulation, tell the computer how to do it and actually get the answer, and this is what has made the difference and has raised the possibility that through suitable research for supplying the basic knowledge, the basic data on properties—what are the thermal properties of this stuff in the back of the chair?

Well, we have some of those. What other chemical properties? They have been studied as a chemist would study it but not for fire purposes, and these additional pieces of effort of a scientific nature, not scientific in the sense of discovering a new law of nature.

We don't have any new laws of nature here to be found. We have to find out how the already known laws of nature fit together and cause the fire to behave the way it does.

I see absolutely nothing that can stop us from doing just what I indicated earlier, be able to design a building that will assure us that everybody can get out, because the time between when the alarm bell rings and when the escape route becomes too hot and too toxic can be calculated, and that is plenty of time for everybody to get out.

This can be done as soon as the basic information has been obtained and the efforts of the Bureau, which is the one and only place in this country where there is any kind of a start made of real significance to—the work done at Factory Mutual is important but small, the work done by various companies is significant but mostly designed for their product purposes, not unimportant but it needs one place to pull this together, and in fact the Bureau's program is now the best in the world.

The Japanese have a good program, somewhat better facilities in many ways, but their total program does not equal that one.

Mr. Brown. Dr. Emmons, I will accept your thesis that there is a huge need for additional fire research, because I think we have not had before the subcommittee a witness with better scientific credentials than you in this field, but the question of whether that is better performed by a Federal centralized research facility or is better performed by some suitable mechanism within the private sector is one to which I do not give you the same credibility as I do the scientific aspects, although I respect your opinion.

We have a number of situations, for example food additives, toxic chemicals and so on, where we lay the burden of doing the research and the testing on the private industry. The chemical industry has huge laboratories and there are many private research laboratories which are engaged full-time in determining the carcinogenic effect of some newly developed product in order to file a registration with the EPA, for example.

They are not allowed to file until they do the research. It is conceivable at least in my mind that we could lay a similar burden on industry for fire research, that we could, say, require that fire insurance companies put 2 percent of their gross revenues into fire research or that a suitable combination of building industries and materials suppliers dedicate certain revenue streams to research, and I think conceive that possibly this is what the administration had in mind. I have seen no specific plan, but I can conceive of such a plan.

Is it your opinion that such a scheme would be completely unworkable, that there is no substitute for the system that we are using here?

Dr. EMMONS. It is clear that if industry were forced to take certain steps, many of them would do so—I think many, some might go out of business because they could not afford it. It would not be desirable to have a number of different laboratories in the forest fire area. We have three major laboratories, all under the Department of Agriculture, one in Georgia, one in California, one in the Northwest, because the fires are different in those areas. The buildings are not all that different.

It doesn't make sense to reproduce the extensive facilities for fire-testing and the extensive instrumentation and the very knowledgeable staff in many different places attempting to put this picture together. It is far better, far more economical, to—far more efficient to do it all in one place.

Now if industry were forced to do it that way, obviously it doesn't matter where the money comes from, the important thing is that there be a consistent piece of money year by year, not every year it goes to zero and then back up again maybe, so that a plan over a period of years can be put together and carried out.

Sure, this could be financed by forcing private industry to do it. I think we have plenty of evidence in what has happened in this world that private industry is not going to do this on their own. It is quite clear that we could design a completely fire-safe building, make it of reinforced concrete, make all the furniture out of reinforced concrete—who wants to sit on a reinforced concrete chair?

This is a compromise between having something that you know is safe, something that you know is unsafe, and somewhere in between we have set the boundary. It is understandable industry sets the boundary here and others set it here. There isn't a rigid boundary that one can set.

It is correct that when industry says we ought to relax that particular fire code requirement, because if you do I can cheapen my product and therefore I do good to the entire public, because they can buy a cheaper product but they buy it at a higher fire risk. That compromise is not one that I would like to see left to those who are trying to sell a product. I would rather have that in the hands of a governmental agency informed of the Code, and I would like to see that Code based on work that is done in a completely nonbiased location as is the Bureau of Standards.

Mr. DELIBERT. If I might comment on that, the system you suggest is not a great deal different from the way we operate now. If the industry were required to pay into a fund for conducting this research, it would be very little different from a tax paid into the Federal Government except it would be a trust fund and it would fall on a narrower base.

Dr. EMMONS. As a matter of fact, the Products Research Committee that operated for 5 years during the 1970s was a research group of nine people appointed as a settlement of a class action suit by the Federal Trade Commission against the plastics industry.

That committee, of which I was a member and John back here I believe is the chairman, received from the plastics industry $1 million a year to be spent on fire safety studies of use of cellular plastics.

In 5 years, $5 million, we have a lot more knowledge, but that is nothing like sufficient to get the information needed to make completely safe use of cellular plastics.

Mr. BROWN. I recognize that if you accept the fact that we should have a certain level of centralized research, the mechanism, really, then doesn't differ too much. It has to be funded in some fashion, but sometimes a user fee as contrasted with a tax is more politically acceptable.

Dr. EMMONS. I might point out that, for example, in the program that I visualized, if the Bureau of Standards or some organization were to do a suitable test of materials, furniture, and other items by which you could obtain the necesseary quantitative fire data would go into a fire program that a city might use for its code, industry will pay for the testing of all of its materials, because you can say here is the standard test, you must do it and then we will have the data that we need to tell whether your product is safe when put in a new building.

Industry will indeed pay for that. To set up a testing laboratory is not what the Bureau of Standards should or will do. They did a few years ago. They had furnaces of various kinds and tested products.

Mr. BROWN. We have a number of examples of industry doing that kind of testing, I agree with you on that.

Mr. Delibert, just in conclusion, if you through your investigations happen on some information relevant to the jurisdiction of this committee, we would be pleased to receive it and follow up on it, and of course we will follow up on our own resources of what we think is appropriate to this subject.

Thank you very much, gentlemen, for your excellent testimony, and we will be in further touch with you.

The subcommittee will adjourn subject to the call of the Chair.

[Whereupon, at 3:45 p.m., the subcommittee adjourned, subject to call.]

APPENDIX I

NBS OVERALL PROGRAMS AND BUDGET

STATEMENTS AND LETTERS

AVCO CORPORATION

DR. DOROTHY M. SIMON
VICE PRESIDENT, RESEARCH

February 16, 1983

The Honorable Doug Walgren
Chairman, Subcommittee on Science,
  Research and Technology
Committee on Science and Technology
Room 2319
Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Chairman:

As Chairman of the Statutory Visiting Committee for the National Bureau of Standards, I am taking this opportunity to present the Committee's views on NBS. Besides myself, the Visiting Committee has four members: Dr. Russell G. Meyerand, Jr., Vice President for Research and Development at United Technologies; Dr. Bernard M. Oliver, Vice President (Retired) of Hewlett Packard Company; Dr. Walter H. Stockmayer, Professor of Chemistry at Dartmouth College; and Dr. Norman F. Ramsey, Higgins Professor of Physics at Harvard University. As you know, the Committee meets twice a year at the Bureau and reports annually to the Secretary of Commerce on its technical activities. In doing so, the Committee benefits greatly from the reports of the evaluation panels chaired by Dr. Mildred S. Dresselhaus (Director, Center for Materials Science and Engineering, Massachusetts Institute of Technology). These panels examine the work of the National Measurement and Engineering Laboratories and the Institute for Computer Sciences and Technology and make recommendations to the NBS management.

The Visiting Committee appreciates the commitment that the Reagan Administration has made to reducing the growth in Federal spending and the severe constraints that that commitment has placed on the budget. We have kept this in mind during our review of NBS activities and in our attempt to identify problems that might reasonably be dealt with in this context.

The last meeting of the Visiting Committee was held on Wednesday, February 2, 1983. At that time the Director of the Bureau of Standards, Dr. Ernest Ambler, reviewed the proposed changes in the 1984 budget with us. The FY 1984 budget provides 25 million dollars or 20% less than the

1275 KING STREET, GREENWICH, CT. 06830 · (203) 531-2800

base budget of FY 1983. Four hundred and seventy-five positions are in jeopardy - 179 are directly tied to programs being eliminated and an additional 296 are vulnerable to overhead reductions and other agency funding.

This severe blow comes at a time when the NBS staff is already lean and just recovering from the disruption of earlier reductions. Over the past two years, the Bureau has reduced its force by 534 people or approximately 15 percent of its staff. The reduction was managed exceptionally well; morale is good, and new initiatives continue to be undertaken through reprogramming. However, cuts of this magnitude have serious long-term consequences. Because the more senior employees have bumping privileges, the Bureau has effectively lost a whole generation of bright young scientists and technicians. A reduction of a further 15 percent at this time would precipitate a major reorganization in the Bureau's management structure and in the use of its facilities. There is no way that this could happen without seriously jeopardizing the ability of NBS to fulfill its mission.

This drastic decrease in the NBS budget is all the more alarming in view of the Administration's proposal to increase the funding of Research and Development (R&D) by 18 percent throughout the government. Thus in a year when the Administration is requesting an increase of 29 percent in R&D for the Department of Defense, 32 percent for the Department of Transportation, and 17 percent for the National Science Foundation, the Department of Commerce is actually requesting a decrease of 28 percent in its R&D budget. The only other agencies or departments requesting substantial reductions in their R&D budgets are the Environmental Protection Agency with a 14 percent decrease and the Department of Interior with 12 percent. Even in the light of the Administration's funding policies, the Department of Commerce seems to be way out of line in its support of R&D.

Of the seven areas in which the Bureau is proposing to make major reductions, I have chosen to comment here on two: fire and building research. The Administration argues that these decreases are largely in short term applied research and development, more appropriately the responsibility of the private sector. Let us examine the possibilities for the private sector to undertake the effort in each of the two areas.

The NBS fire program is the only Federal effort aimed at the reduction of annual fire losses of 8,000 lives, 200,000 injuries, and $20 billion in costs. Fires in residences, such as homes, hotels, and care facilities, account for 77 percent of these deaths, 68 percent of the injuries and 46 percent of the dollar losses. The NBS program is the only technical effort in this country directed towards the problem of residential fires. Its results are used by designers, manufacturers, builders, standards writing committees, and State and local code officials.

Except in special cases, the private sector has no incentive to conduct research into fire safety. Fire insurance underwriters deal with the protection of property; since they generally set premiums on an actuarial basis, their profit does not depend on reducing losses. The NBS program is aimed at the protection of life.

In those special cases where the private sector does conduct efforts to reduce fire losses, their activities are usually mission oriented and narrow in scope. As such, they do not overlap with those of the Bureau. NBS does not, for example, engage in technology or development of commercially marketable materials. Nor does NBS do routine tests; product certification is handled by Underwriters Laboratories, Inc. The Factory Mutual Research Corporation, the largest non-government fire laboratory in the country, does indeed address fire protection of industrial buildings and their contents, but industrial fire protection systems are not suitable for residences. Thus NBS conducts the only comprehensive fire research program in the country. Its program is designed to provide the scientific basis for the prevention and control of all types of fires.

A decade ago, NBS scientists provided basic information on the characteristics and movement of smoke. This information was incorporated into the test procedures used in certifying smoke detectors, which now save 1,000 lives annually. More recently, NBS scientists identified cigarettes as the single largest source of fatal fires. Their work in developing test methods for determining the resistance of mattresses and upholstered furniture to cigarette ignition has the potential of reducing fire fatalities by 20 percent.

In addition to the work carried out on site, NBS is the principal source of support for fundamental fire research throughout the United States, providing annual funding of $1.75 million to about 30 universities. This is consistent with the Administration's policy to derive educational and training advantages from federally-supported research. In maintaining these contracts, the Center for Fire Research provides the link between university research and the needs of fire technology.

Improvements in the cost-effectiveness of fire protection systems can have significant economic returns. The construction of new buildings and the rehabilitation of existing buildings runs about $230 billion annually; $7.6 billion is spent on fire safety. Forty percent of this expenditure could be saved by making more informed decisions on the trade-offs between safety, cost and function. The NBS Fire Safety Evaluation System allows designers to make just such decisions in meeting the requirements of the Life Safety Code. In rehabilitating one hospital, use of NBS guidelines saved $4 million out of an $11 million project; in another hospital, it saved $2 million out of $5 million.

The beneficiaries of the NBS fire research program are the general public. To eliminate this program would be to neglect the Nation's severe fire problem.

The issues associated with the elimination of the Bureau's program in building research are different but equally complex. Construction is one of the Nation's largest industries. In 1981 it amounted to $234 billion or eight percent of the gross national product. Sixty-nine percent of the Nation's wealth is invested in constructed facilities that shelter and support almost all human activities. NBS is the only comprehensive, non-proprietary laboratory dedicated to meeting the measurement requirements of the building community. Its program includes substantial efforts in structural engineering, building materials, building equipment and systems. Authorized by the NBS Organic Act of 1901, the Center for Building Research has led the national effort in building research for 80 years.

There are other organizations that could be considered to conduct the building research associated with the budget reductions at NBS. But each of these has its own particular skills, facilities and enthusiasms. No one of them could readily be expanded into an integrated program capable of dealing with the complex technical issues that affect the entire building industry. The Department of Defense, for example, focuses its research programs on problems related to military applications. Many problems of interest to the building community are not included. Several defense laboratories have sponsored research at the Center for Building Technology in order to take advantage of the technical expertise and unique experimental facilities not available elsewhere.

The larger manufacturers of building materials and equipment also conduct research related to building technology. But here the effort focuses on the development of new products. Most of the work is proprietary and does not address the diverse technical problems of the building community. These laboratories could not perform the generic research oriented towards performance that is conducted by NBS.

NBS is the only neutral laboratory capable of investigating the physical causes of major structural failures. It reported on the collapse of the walkway in Kansas City that killed 114 people in 1981, the failure of the overpass in East Chicago that killed 13 construction workers in 1982, and the collapse of the cooling tower at Willow Island that killed 51 construction workers in 1978. Such reports assure that the causes of the disasters are publicly known and can be avoided in the future.

NBS is the major source of non-proprietary information for use by building code officials for revision codes and for determining compliance. This program makes major contributions toward reducing the burden of unnecessary building regulations while maintaining essential levels of safety. For example, NBS, in cooperation with the National Conference of States on

Building Codes and Standards, developed a more cost-effective approach to regulating the rehabilitation of buildings. This approach has been adopted by the State of Massachusetts and incorporated in rehabilitation guidelines of the Department of Housing and Urban Development. In still another example, NBS formulated an approach for design standards for energy conservation in buildings. This has been adopted as a national standard by the American Society for Heating, Refrigerating and Air-Conditioning Engineers. It provides the basis for the energy building code of 44 States.

The construction industry is one of the three major disaggregated industries in the country. The other two are health services and food. From a statistical abstract published by the Department of Commerce in 1981, it appears that the health service industry received $4 billion in Federal research support, and the food industry $890 million. The comparable figure for the construction industry is $22 million, all of it at NBS. With over 4 million construction workers and over one million construction firms, the industry simply could not organize itself to conduct this research without Federal support.

I have attempted in this letter to convey to you the seriousness with which the NBS Visiting Committee regards the proposed elimination of the Centers for Fire Research and Building Technology. Every major country in the world has found it necessary to maintain a fire research laboratory in its central government; every developed country in the world has a building research laboratory. I hope the Committee on Science and Technology will give its full support to these two national assets.

Sincerely,

Dorothy M Simon

Dorothy M. Simon
Vice President, Research
Avco Corporation
Chairman, National Bureau
of Standards Statutory
Visiting Committee

DMS:vh

American Association
for the Advancement of Science

1776 MASSACHUSETTS AVENUE, NW, WASHINGTON, D. C., 20036

Phone: 467-4400 (Area Code 202)   Cable Address: Advancesci, Washington, D. C.

February 17, 1983

The Honorable Douglas Walgren
Chairman, Subcommittee on
Science, Research, and Technology
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Walgren:

As a former Chairman of the Statutory Visiting Committee for the National Bureau of Standards I am appalled by the Administration's 1984 budget proposals for the NBS. There is no logic to them in the context of the government's concern for strengthening U.S. scientific and technological assets for defense and economic recovery.

The work of NBS may not have a high public profile, but it is critical to advances in the physical sciences, engineering, and mathematics. Both industry and government depend on NBS for measurements and standards that are vital to both product and process reliability and quality control.

To me it is nearly inconceivable that in a budget which raises total R&D funding for 1984 by 17 percent above the 1983 level, the Bureau of Standards is forced to take a 16 percent cut. I am unable to reconcile this with the Budget statement that "Advances in research in the physical sciences and engineering are key to future national defense and the long-term competitiveness of the U.S. economy, particularly in high technology industries."

The casualties resulting from OMB's decisions include terminating the fire science and engineering program, building research, recycled oil programs, and cutting back government-wide ADP standards programs and automated manufacturing research. In the case of both fire research and building research, the argument is offered that the private sector should do such work. You and I know that the private sector has never done it and never will. In the case of government-wide ADP standards, NBS has a statutory responsibility aimed at bringing efficiency and order to the Balkanized information systems operated by government agencies, and a cut like this will only make a bad situation worse. As for automated manufacturing research, the know-how and inventiveness of the NBS constitute important U.S. assets in the race to match foreign competitiveness. It is the last place to reduce research momentum.

It is apparent that NBS is an orphan in the family of Federal centers for research and development, and that it has no responsible champion. Although I am out of the picture and a bystander, I have chosen to express my views to you in the hope that the Congress will see fit to apply appropriate damage control. With $7 billion of additional funding earmarked for R&D in the next budget it should be possible to at least maintain the current program level at the NBS.

Sincerely,

William D Carey

William D. Carey
Executive Officer and
Publisher of Science

UNIVERSITY OF MARYLAND
COLLEGE OF HUMAN ECOLOGY
COLLEGE PARK 20742

DEPARTMENT OF
TEXTILES AND CONSUMER ECONOMICS

AREA CODE 301 - 454-2141
2100 MARIE MOUNT

March 21, 1983

The Honorable Don Fuqua (Florida)
Chairman, House Committee on
Science and Technology
U.S. House of Representatives
Washington, D.C. 20515

RE: National Bureau of Standards

Dear Mr. Chairman:

I am writing to express my strong support for the National Bureau of Standards (NBS), during its current round of Senate and House of Representatives hearings on its 1984 Appropriations and Authorization.

I have known and had the distinct pleasure of working closely with several groups at NBS for the past twelve years. Particularly, my experience relates to their Center for Fire Research, and their National Voluntary Laboratory Accreditation Program (NVLAP). As a University scientist, and active member of the U.S. and international standards community, I have the highest regard and respect for NBS and its many vital activities, including fire research, and laboratory accreditation. Both of these programs are of significant value to the nation's safety, and to the efficient functioning of its business community, respectively.

I urge you to continue strong financial support for NBS and certain of its key programs. NBS does not have an "equal" outside that can replace the loss of these programs which I have mentioned. As one of this nation's premier research and development and industrial support centers, it is imperative that NBS remain a strong and vital force within our government and its Department of Commerce. Our people and our business community both benefit greatly by NBS programs in Fire Research, and in Laboratory Accreditation. Other government agencies benefit from the services and expertise that only NBS can provide. NBS is the government's "University," in a way, and is too valuable to be frittered away by budget and program cuts. Our nation more than ever now needs these NBS programs.

Please let me know if I need elaborate further for your records on any of the above matters, or respond to any questions in particular which you may have.

Sincerely,

SMSpivak

Steven M. Spivak, Ph.D., FTI
Associate Professor

SMS/ao

APPENDIX II

FIRE RESEARCH PROGRAM

STATEMENTS AND LETTERS

WHA WOOD HEATING ALLIANCE

1101 CONNECTICUT AVENUE, N.W. SUITE 700, WASHINGTON, D.C. 20036—202/857-1181

February 17, 1983

Hon. Doug Walgren, Chairman
Subcommittee Science Research & Technology
Committee on Science & Technology
2321 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Walgren:

The Wood Heating Alliance urges you to restore the budget of the Center for Fire Research in the National Bureau of Standards.

The Wood Heating Alliance is the national trade association of woodstove manufacturers and dealers. We feel strongly that the entire country has benefited greatly from the basic research being conducted by the Center for Fire Research (CFR).

The CFR has been conducting important research into the formation of creosote from solid fuel appliances and into safe techniques for venting solid fuel appliances through combustible walls. The Consumer Product Safety Commission has identified these issues as the chief causes of home fires related to solid fuel appliances. The CFR research is vital to our efforts to improve public safety in the use of these devices.

The woodstove industry is a small and fragmented industry. Hundreds of small manufacturers produce the appliances and none of them have the resources to conduct the needed research in these vital safety areas.

The CFR has done a fine job communicating the results of its research to our industry. We expect that our industry will make full use of the CFR research in the new product designs and safety measures.

We hope your Subcommittee will restore the funds in the FY 1984 budget for the CFR research.

Sincerely,

Carter Keithley
Executive Director

CK/d

Society of
Fire Protection Engineers

Advancing the Art and Science of Fire Protection Engineering

60 Batterymarch Street
Boston, Massachusetts 02110
617 482-0686

February 28, 1983

The Honorable Douglas Walgren
Chairman, Subcommittee on Science, Research
& Technology
Committee on Science and Technology
U.S. House of Representatives
Washington, DC 20510

Dear Sir:

The Society of Fire Protection Engineers is deeply concerned for the future of the Center for Fire Research of the National Bureau of Standards. Its demise would seriously curtail advances being made by the CFR in the science and technology of fire.

Enclosed is a statement which reflects our opposition to the current proposal to eliminate the CFR. Please enter it as an official part of the record of your oversight hearings.

Sincerely,

Maurice R. Boulais

M. R. Boulais, P.E.
President

cc: Dr. John Holmfeld
Carrye Brown

encl.

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February 28, 1983

Statement To:

Subcommittee on Science, Research, & Technology
Committee on Science and Technology
U.S. House of Representatives

In Opposition to the Elimination of the NBS Center for Fire Research

The Society of Fire Protection Engineers (SFPE) is the international technical Society for engineers involved in the multifaceted field of fire protection engineering. Its 3350 members, located primarily in the United States, include engineers in private practice, in industry (automotive, utility, ferrous and non-ferrous metal, petrochemical, petroleum, retailing, etc.), in government (local, regional, and national), in manufacturing and installation of fire protection equipment, as well as technical members of the casualty insurance industry.

The SFPE long range plan includes significant ties to fire research. This fact causes the SFPE deep concern for the potential elimination of the Center for Fire Research (CFR).

The statement of purpose for SFPE is: "to advance the application of engineering principles to protect man and his environment from fire." Two goals of the long range plan based upon that purpose are particularly germane . . . goal 1: "Professional Practice - to advocate the development and application of engineering principles with integrity, objectivity, and technical quality"; and goal 2: "Education - to transfer modern theory, principles, and practice to current and prospective fire protection engineers, allied professionals, and others."

The output of the CFR is in great measure not only used by the fire protection engineer in his daily practice but is a primary factor in the technical advancement of the profession which is to protect life and property from unwanted fire. Three examples will illustrate.

In 1975, a five year program was initiated at the CFR to develop a quantitative evaluation system for grading the fire safety of health care facilities. Users of the system can determine combinations of widely accepted fire safety equipment and building construction features which provide a level of fire safety equivalent to that required by the widely accepted "Life Safety Code" of the National Fire Protection Association (NFPA). The system provides flexibility to both the designer of new facilities and to the renovator of existing health care facilities. Equivalency is judged to exist when the total input of the occupancy risk factors and the compensating building fire safety features produce a level of fire safety equal to or greater than that achieved by rigid conformance to the explicit requirements of the NFPA "Life Safety Code." In this evaluation, fire safety performance is guaged both in terms of overall fire safety impact and in the depth of redundance.

This system is in place today and fire protection engineers are using it to evaluate innovative engineering approaches to fire safety in health care facilities, such as those of the Veterans Administration. This effort is continuing and in current development are evaluation systems for apartment buildings, board and care homes, homes for the elderly, prisons and jails, seasonal hotels, and in the future coal mines.

Without the CFR, this pioneer system would not have been developed or would have been delayed. The cost savings resulting from this evaluation technique would not have been realized.

CFR, in a second project important to the fire protection engineer, is developing means to predict the actual burning hazard of furnishings used in a building such as upholstered furniture, desks, tables, chairs, filing cabinets, etc. Hazard is expressed in rate of energy release, smoke development rate, and toxic gas production. This will enable the engineer to predict the total amount of energy and other products of fire likely to be produced within a given room or group of rooms. With this, the engineer can evaluate the total impact of fire on the building occupants and on the structure. Then, rather than arbitrarily condemning a particular furnishing because of its hazard potential, alternative fire safety features can be designed and the total hazard managed.

This breakthrough can be further applied to places of public assembly such as theaters, sports arenas, and schools thus enabling the fire protection to be engineered on the basis of the potential output of an unfriendly fire in the particular structure.

An effort such as this, in all probability, could not have been undertaken by the private sector because it involves such a myriad of industries and special interests . . . man made fabrics, natural fabrics, wood, plastics, steel, aluminum . . . none of which would independently have sufficient incentive to undertake the research.

CFR in another project is applying theories of thermodynamics and fluid mechanics to fire. This effort is providing engineering calculations that can measure or predict fire development without actually having a fire. In the past, it has been necessary to conduct expensive and sometimes inconclusive large and small scale fire tests, to observe working fires or to rely on post fire investigations.

Fire protection engineers need such substantiated theory now in development at the CFR. With the theory discussed above, the engineer could predict the migration of smoke and toxic gases. Given such a prediction, a system could be designed which would assure that occupants of any particular structure could make a timely escape from any potential fire. This work like the previous examples is uniquely peculiar to the mission of the CFR and would not likely be undertaken in the private sector because it is not oriented to a single industry.

Engineering is the application of scientific principles to practical ends such as the design, construction, and operation of efficient and economical structures, equipment, and systems. Fire protection engineers need the CFR so that they may continue to apply "scientific principles" in a manner which produces "practical ends." Those practical ends are the protection of life and property from fire. And according to the NFPA, fire cost America 6,700 civilian deaths and in excess of $6 billion in property damage in 1981. Mainenance of the CFR at $5.89 million or .01 percent of the $6 billion annual loss is appropriate.

UNIVERSITY OF CALIFORNIA, BERKELEY

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COLLEGE OF ENGINEERING
MECHANICAL ENGINEERING

BERKELEY, CALIFORNIA 94720

March 2, 1983

Honorable Doug Walgreen
Member of House of Representatives
Washington, D.C. 20515

Dear Congressman Walgreen:

May I ask for your assistance in saving many lives, avoiding uncountable heinous injurys, and preventing future disasters?

It is inconceivable to me that the United States, whose national fire loss record is already one of the worst in the world (recent catastropic fires at the MGM Grand Hotel, the Stouffer Inn, and the Westchase Hilton Hotel do little to ameliorate this record), would choose to become the only major civilized nation without a national fire center. And yet the current budget proposal does precisely that - it terminates the Center for Fire Research at the National Bureau of Standards within the Department of Commerce.

This Center is the worldwide leader in fundamental fire research with an excellence level truely unusual in government or university research centers. The Center provides a focus for fire related research and application activity throughout the United States and indeed the world. Without this focus, our life and property losses to fire would assuredly climb exponentially. There will also be serious consequences to national and civil defense (the burning of the Sheffield and other ships at the Falkland Islands dramatically emphasize the need for further fire research).

This is a technical question. Please note my professional opinion that proper fire safety assessment is at the very forefront of combustion research. Manufacturers do not have and cannot afford to obtain the competence required to replace this Center.

I too am concerned about high government budget deficits. But this is false economy. The "saving" of the Center's yearly budget of 6 million dollars will not bear the scrutiny of cost-benefit analysis.

Please vote to restore the Center for Fire Research to last year's level of support in this year's budget. I thank you and our children and grand children will thank you.

Sincerely,

Patrick J. Pagni
Professor

NFPA®
"Moving Mankind Toward Safety From Fire"

NATIONAL
FIRE PROTECTION
ASSOCIATION
INTERNATIONAL

ROBERT W. GRANT, President

March 8, 1983

Honorable Doug Walgren
House of Representatives
Washington, DC 20515

Dear Mr. Walgren:

National Bureau of Standards
Center for Fire Research
1984 Budget

In your release of February 25, 1983, you ask that organizations with an interest in the National Bureau of Standards work to respond with information, statements or testimony on the elimination of essential programs.

As the principal advocate for fire safety and the producer of over 200 fire safety standards, the National Fire Protection Association shares your deep concern that the Center for Fire Research at the Bureau is threatened with elimination.

The suggestion that the private sector should take up these research activities is completely unrealistic. The type of work done by the Center for Fire Research is that which only the Federal government can perform.

Private sector research must obviously be related to a market. The fire safety research at NBS has no market potential, it is not product-related, and it is carried out in the broad public interest. If the Center is eliminated, there will be a void created that cannot be filled.

I have enclosed our position statement on this issue which sets out what I feel is a convincing justification for reconsideration of the zero funding for the Center for Fire Research.

It is not often that a federal agency provides an essential service to the nation, with a demonstrated record of achievement and does it in a very cost-effective manner as is the Bureau. The fire problem in this country has not yet been eliminated, but the Center for Fire Research is certainly helping resolve it. To stop this program would be a disservice to the nation.

Yours sincerely,

Robert W. Grant
President

Enclosure

EXECUTIVE OFFICE: BATTERYMARCH PARK, QUINCY, MASSACHUSETTS, U.S.A. 02269 • TELEPHONE (617) 328-9290 • TELEX 94-0720
The non-profit technical and educational organization. To promote the science and improve the methods of fire protection and prevention, to obtain and circulate information on these subjects and to secure the co-operation of its members and the public in establishing proper safeguards against loss of life and property by fire.

NFPA®
"Moving Mankind Toward Safety From Fire"

NATIONAL
FIRE PROTECTION
ASSOCIATION
INTERNATIONAL

STATEMENT CONCERNING THE PROPOSED ELIMINATION OF THE CENTER FOR FIRE RESEARCH WITHIN THE NATIONAL BUREAU OF STANDARDS

submitted to the

Subcommittee on Science, Research and Technology
Committee Science and Technology
United States House of Representatives

by the

National Fire Protection Association
Batterymarch Park
Quincy, Massachusetts 02269

March 16, 1983

EXECUTIVE OFFICE BATTERYMARCH PARK, QUINCY, MASSACHUSETTS, U. S. A. 02269 • TELEPHONE (617) 328-9290 • TELEX 94-0720
The non-profit technical and educational organization. To promote the science and improve the methods of fire protection and prevention, to obtain and circulate information on these subjects and to secure the co-operation of its members and the public in establishing proper safeguards against loss of life and property by fire.

The National Fire Protection Association (NFPA) expresses its concern over the Administration's FY'84 budget proposal that would provide zero funding for the Center for Fire Research (CFR) within the National Bureau of Standards (NBS) and, thus, eliminate this important scientific research unit within the Federal Government.

The NFPA, founded in 1896, is a non-profit, technical and educational membership organization. It has remained the principal public advocate for fire safety since its inception. The Association's membership of over 32,000 is drawn from the many disciplines involved in, and concerned about, the national fire problem. NFPA is not a trade or industry association. No one group or interest is dominant. The only common membership denominator is a concern about fire safety. Members include fire service personnel, fire marshals, electrical inspectors and city managers; architects, engineers and educators; health care facility operators and similar groups from commerce, industry, insurance and the Federal Government. The NFPA is best known for its voluntary safety standards, collectively known as the National Fire Codes which, in whole or in part, are incorporated by reference into numerous federal and state laws and into municipal ordinances.

The proposed elimination of the NBS Center for Fire Research follows the Administration's FY'83 proposal to eliminte the United States Fire Administration (USFA), which is presently located within the Federal Emergency Management Agency.

Thanks to action by the oversight and the appropriations committees, although curtailed and redirected, the USFA was saved. This year the elimination of the Center for Fire Research is being proposed at the same time that reauthorization for the USFA is being sought.

In NFPA's view, the existence and continued functioning of both the USFA and the NBS Center for Fire Research is essential. Historically, the NBS has had a fire research capability since 1904, at which time standardization of fire hose couplings was at issue. In subsequent years, the Fire Resistance Section had been established within NBS, and in 1968, with the enactment of the Fire Research and Safety Act of that year, the organization was formalized. Subsequently, Section 18 of the Fire Prevention and Control Act of 1974 amended the NBS Organic Act thereby creating the Center for Fire Research in its present form.

It would be a mistake to view the workings of the NBS Center for Fire Reserach as simply abstract, scientific experimentation. Although the Center is a community of scientists and engineers and much of the work is, in its initial form, relatively abstract, one of the distinguishing features of this particular part of NBS is that the Center goes beyond this initial research to produce practical tools that have great benefits.

For example, the Center began fundamental studies of residential smoke detection in 1972. At that time, home smoke alarms were virtually unknown in this country. Two years later, a test method for residential detectors was published by NBS and adopted by Underwriters Laboratories as the basis for that organization's certification and labeling program. These developments set the stage for the explosion of smoke detector sales in this country. Now, less than ten years after the Center's first inquiry, two out of every three homes in the United States has this life-saving device. In NFPA's judgement, that would not be true if it weren't for the pioneering work of the Center for Fire Research.

One reason we feel safe in most buildings is that we are fairly confident that a fire will not cause them to collapse before we can get out. Buildings don't just happen to be built that way -- the concepts of fire endurance, which are the bedrock of modern fire protection, were developed at NBS fifty years ago.

When you go home this evening, take a moment to look at your carpet; work completed at NBS in 1970 has ensured that carpet manufactured since that time will not ignite from a dropped match or similar small ignition source.

No mattresses sold legally since 1973 will ignite from a cigarette -- again thanks to work done at NBS.

There is scarcely an area of practical fire protection which does not show the imprint of work done by the Center. Fire fighters today wear improved protective clothing; buses, subways, trains and airplanes are more fire safe; hospital and nursing home fires are increasingly uncommon -- all due to research done and put to practical end use as a result of the work of the Center for Fire Research.

NFPA doesn't think anyone can seriously suggest that the Center doesn't earn its keep -- a single famous hospital in Massachusetts saved more money by applying CFR-developed fire protection technology than it costs to operate the Center for eighteen months. Rather, the issue is whether the private sector can do as well or better in providing this technology. In our view, it cannot -- in fact, it can't even come close.

It takes money to do this work, and in the private sector, one cannot spend money unless there is a clear financial return. Safety standards, such as those of NFPA, invariably involve product exclusions. This means that the research that often underlies the standard must be technically sound and free from bias. Even when privately funded research meets these tests, the conflict level that accompanies standards development will be raised. That level is already high, and the risk is run of having fire safety being finally determined in the courtroom, not the laboratory. By the same token, the costs of standards development would increase dramatically.

The crucial and irreplaceable element that NBS brings to the fire safety community is credibility. Private funds doing the same research, just as well, could not have the same impact.

Furthermore, the Center is an interdisciplinary organization. No single industry would be willing to support such a diverse collection of specialties. Yet, without that diversity, the breakthroughs are not going to be realized.

For example, mention was made that the Center had developed cost-saving technology for hospitals. That involved the concept of the Fire Safety Evaluation System (FSES) for Hospitals and Nursing Homes, a concept that is now also part of the National Fire Codes. Using this system, building owners and developers can meet code requirements with far more flexibility and, therefore, at much lower cost than was previously the case. The savings potential for health care facilities alone in the United States is in the billions -- and comes at a time when other health care costs are skyrocketing. On one hand, the Center had assembled the physicists, psychologists and engineers to compare and evaluate fire protection methods and, on the other, the Center had the credibility in the building and regulatory community to gain review and acceptance of the concept from those who would use it day-to-day.

In summary, considering the highly-charged nature of the work done by the Center for Fire Research, it is absolutely essential that this work continue within government, and not in the private sector, as this possibility is being proposed by the Administration. It cannot be transplanted effectively; and it cannot be transplanted at all without creating a vacuum in essential independent research and opening a door to judicial challenges.

Further, the locus of the Center for Fire Reserach within the NBS, and not in some other government agency, is fully justified because of the universal recognition of NBS' scientific stature and because of the beneficial synergistic effects that comparison and correlation with other scientific disciplines in NBS provides. Not one university or private research institution in the United States is able to provide this inter-disciplinary approach.

As we are sure the Subcommittee will realize, the Center's work products not only benefit the NFPA, but also underlie much of the private sector's product certification activities.

To emphasize our point once again, even if the NBS Center for Fire Research could be physically duplicated within the private sector, the credibility of such an entity would be far less than that of the existing NBS organization. Much more can be said on this subject, and we have tried, in an attachment to this statement, to deal briefly with a few of the most important aspects of the question: "What if the CFR is shut down?"

The NFPA also supports fully the work of the NBS Office of Product Standards Policy which, at present, supports private sector standardization initiatives and performs a valuable function in both international and domestic standardization, product certification and accreditation of testing laboratories.

In conclusion, the NFPA urges the Subcommittee on Science, Research and Technology to recommend continuation of the Center for Fire Research at the FY'83 funding level.

Attachment

WHAT IF THE CFR IS SHUT DOWN?

1. Combustion toxicity is an issue where the CFR is required.

The tremendous public debate over combustion product toxicity is one in which there is almost no neutral ground. Those responsible for public safety get facts from combustible materials industries on one side, and those who make non-combustible products on the other. While there may be valid points on both sides, regulators are poorly equipped to determine which materials are fact and which are simply self-serving in this complex area. The Center is the only credible source of technical information and, hence, occupies the only neutral ground in a hotly contested arena.

Neither NFPA nor the two largest independent fire testing laboratories have any biological testing capability. Several smaller testing laboratories do, but they are all already trying to sell their particular tests, so it's hard to see who would fill the need for neutrality. Yet, if the laboratory is not funded, near anarchy could result.

2. Private sector not equipped to pick up work of the CFR.

As part of NBS, the Center for Fire Research's job is to develop methods to measure fire performance and to help decide what level of performance is needed. By contrast, industry provides proprietary products and services. In fire protection, these proprietary products usually must meet specific requirements -- requirements that are often set based on work done by the

Center. At present, NBS and the private sector do not compete, but perform complimentary functions.

If the Center were to be abolished, the private sector would have to take on the role of umpire where now it is a participant in the game, and this raises a potential for severe conflict of interest.

3. Other countries have national fire reserach laboratories.

Most Western European countries, Canada and Japan have government-supported fire research laboratories. (Even China and the Soviet Union have such organizations.) Although input from the private sector is encouraged, in no case is the responsibility for code-related research left in the hands of industry.

4. Center supports most fire research in this country.

If funding is halted for the Center, virtually all fundamental research in fire would cease. This is because the Center supports all of the university-based research in the area, as well as its own in-house program.

Therefore, shutting down the CFR shuts down more than an organization -- it shuts down an entire area of science.

5. Rebuilding capability at the CFR is not readily done.

In addition to its operating budget, the Center has perhaps $10 million in equipment and facilities, most of it immovable.

If the private sector were to assume the role now played by NBS, NBS would either have to make these facilities available to tenant researchers or the facilities would have to be duplicated elsewhere.

Where testing is routine, private laboratories already duplicate a portion of these facilities and carry out testing on a business basis. For example, Underwriters Laboratories uses a number of CFR-developed tests as part of its listing services.

The development of test methods and criteria involves a breadth of staff and facilities that even the largest private labortories do not possess. It is obviously more cost-effective for NBS, using existing laboratory facilities, to continue developing test methods than for several laboratories, independently, each to build such facilities.

UL
UNDERWRITERS LABORATORIES INC.
333 PFINGSTEN ROAD · NORTHBROOK, ILLINOIS 60062
an independent, not-for-profit organization testing for public safety

March 8, 1983

The Honorable Douglas Walgren
Chairman, Subcommittee on Science,
Research and Technology
U. S. House of Representatives
Washington, DC 20515

Subject: Underwriters Laboratories Inc. (UL) Commentary in Opposition to the Elimination of the National Bureau of Standards (NBS) Center for Fire Research (CFR) as Related to Proposed Department of Commerce (DOC) Fiscal 1984 Budget Reductions.

Dear Mr. Walgren:

This is pursuant to recent telephone conversations with your assistant Ms. Carrye Brown. We thank you for the opportunity to comment on the proposed 1984 budgetary cuts which would result in the elimination of the Center for Fire Research of the National Bureau of Standards. We recognize the necessity to seek ways to reduce the mounting Federal deficits and appreciate the hard choices faced by Congress and the nation, but the elimination of the CFR would be a severe setback to the goal of reducing deaths, injuries and property damage from fire.

UL is an independent third party laboratory providing testing evaluation, inspection and product marking services for electrical and mechanical products, building materials, construction systems, fire protection equipment, and marine products to determine that the design and performance of such products provide for reduction of the risk of injury to persons and damage to property during use; to identify such products through a system of marking that permits recognition by consumers, authorities having jurisdiction, and others; and to establish, through contractual arrangements with manufacturers for UL's audit (inspection)of production, conformance of products with applicable requirements contained in UL's Standards for Safety and/or the standards of other nationally recognized organizations.

March 8, 1983

Our position on this matter is based upon a close association with the work of the NBS in the area of fire research dating back to the early stages of this science over 70 years ago. UL's beginning dates back to 1894. Contact between UL and NBS dates back to the early part of this century and included early research and test development work on fire protection building elements, i.e., doors, walls and columns. The availability of comprehensive fire test method development facilities and staff capabilities at the NBS has provided an important, unbiased centralized service to UL and U.S. industry, as well as governmental agencies, for decades. The NBS program draws on the expertise of the private sector through a myriad of communication modes including grants, research contracts, seminars, symposia, formal meetings, mutual participation in national and international technical committee activities and research associate and personnel exchange programs.

The composition of the fire community in the U.S. is widely diversified, including scientists, engineers, fire professionals, regulators, testing laboratories, product performance certifiers, architects, builders, manufacturers and users. This diversity requires the existence of a central organization to coordinate the research carried out toward the development of new fire test methods and technologies for use by product testing organizations, certifiers and regulators. This coordination is an essential element in the fire safety system used in the U.S., particularly since the safety of the public is at stake. The NBS-CFR has served as a stable central source for reliable research of fire test methods and technologies, using specialized equipment and highly and uniquely qualified personnel, that could not otherwise be brought together within the private sector even if funding could be made available. A truly significant void would be left if the NBS-CFR program is eliminated in its present form. Many, if not all, of the research services provided by the NBS-CFR would never again positively impact on the testing of products requiring fire evaluations.

Consideration of the diversification of the NBS-CFR program provides insight into its scope and over-all impact on fire protection in the U.S. NBS-CFR conducts or supports research in the following areas now specifically requiring the development of scientific knowledge:

> Basic fire phenomena such as ignition, fire spread, smoldering fires, radiation fires and soot formation.
>
> Comprehensive work in the development of combustion products toxicity and smoke generation and movement test methods - two primary elements of a fire risk assessment.

Development of effective, economical high-rise building fire protection systems - encompassing the complex combination of fire suppression mechanisms (sprinklers, etc.), smoke control methods, fire detection (smoke and heat detectors) interior finish materials (fire spread resistance) and construction materials and assemblies (fire rated walls, floors, ceilings and columns).

Development of computer-based fire simulation and prediction methods - a successful future in fire science, research and technology in the U.S. may very well depend on such a comprehensive program for designing buildings through computer-based methods.

The five year program initiated at the NBS-CFR to develop a quantified system for evaluating the nation's progress toward reducing fire deaths and property losses on a goal-oriented basis was unique and would not likely have been carried out elsewhere within the government or in the private sector. If the CFR program had not existed, this unique system might have been delayed or never developed. The over-all economic advantages of this system have yet to be fully measured but it can be said that in the long range, the cost savings alone could justify the continuation of the NBS-CFR. This and many other unique efforts of the NBS-CFR would probably not have even been undertaken in the private sector, or simply could not have been efficiently funded since in many, if not all instances, these efforts are oriented toward the widely divergent interests mentioned earlier rather than to a single interest.

The NBS-CFR has served an important allied research function on the development of fire test methods used extensively by the private sector in establishing compliance with prevailing National Codes and Standards. Specific examples of these joint NBS/UL cooperative efforts include:

Fire performance and wind resistance testing of building roof coverings.

Surface burning characteristics of interior finish building materials.

Smoke movement through doors, dampers and windows in buildings.

Smoke detector testing and sensitivity evaluation techniques.

March 8, 1983

Smoke generation testing methods for building materials.

Large-scale fire research testing to measure the effectiveness of large-scale test methods.

Computer-based fire modeling techniques.

The nation must continue to have the benefit of the coordination and unbiased evaluation of the fire sciences, research and technology being used to protect its citizens offered by the NBS-CFR program. The mission of the NBS-CFR must transcend budgetary concerns for it represents a program aimed at reaching one of the highest goals set down for any elected administration, namely, to "promote the general welfare."

We urge those in government responsible for the fiscal 1984 DOC budget to take whatever steps are necessary to continue the high priority program of the NBS-CFR in operation.

We appreciate the opportunity to express our views on this most important matter.

Sincerely,

Jack Bono

JACK BONO
President

JAB:AGA

G.T. Castino

G. T. CASTINO
Assistant Vice President
and Chief Engineer -
Fire Protection

CITY OF PHILADELPHIA
FIRE DEPARTMENT
3RD & SPRING GARDEN STREETS, PHILADELPHIA, PA. 19123

JOSEPH R. RIZZO
COMMISSIONER

March 14, 1983

The Honorable
Doug Walgren
Chairman
Subcommittee on Science,
Research & Technology
U.S. House of Representatives
Washington, D.C. 20515

Dear Congressman Walgren:

I would very much have liked to testify regarding the Fiscal Year 1984 Budget Proposal for Federal Fire Prevention and Control programs, but another commitment makes this impossible.

I would like to go on record as a firm supporter of the United States Fire Administration, the National Fire Academy, and the need for adequate funding of these agencies.

After 26 years of employment with the Philadelphia Fire Department and seeing the great strides that have been made in recent years regarding fire prevention and fire protection, I can assure you and the members of your committee that only through increased focus on the national fire problem can this trend continue.

If I can ever be of service, please do not hesitate to ask.

Sincerely,

J. Walsh

Harry J. Walsh
Deputy Chief
FIRE PREVENTION DIVISION

HJW:kvw

OFFICE OF THE

Westmoreland County Commissioners

101 Courthouse Square
Greensburg, Pennsylvania 15601
412/834-2191

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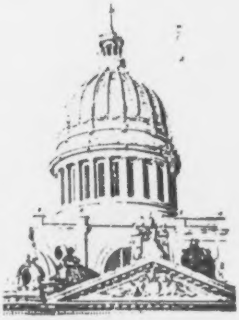

March 15th, 1983

The Honorable Doug Walgren (D-PA)
Subcommittee on Science, Research, and Technology
House Committee on Science and Technology
2321 Rayburn Building
House of Representatives
Washington, D.C. 20515

Dear Congressman Walgren:

We are urging your support towards continuation of the budgeted programs designed to develop scientific data to reduce fire deaths and injuries in this nation.

Our position is more rigid labeling of materials standards must be developed as a by-product of research, concerning the manufacturing of synthetic building products for residential use. Today's firefighter is subjecting his body to more toxic smoke and gases than ever before in the history of this country. Yet, only limited information is available on the toxicity of building materials used in today's construction industry. An example would be certain type of insulation used in residential construction subjected to heat and flame produces cyanide and/or formaldehyde gases. Should a firefighter's self-contained breathing apparatus develop leakage or become inoperable, or his personal gear get torn, severe injury and possibly death may occur as the result of his body being subjected to toxic vapors. Required "toxicity of material" labels on building materials which have been tested through research would be a good start. In summary of this first part, "toxicity" is defined as the ability of a material to cause bodily harm by chemical action. The scientific data of the manufacturer is already there. Now it is up to the federal government to make sure the data available can be directed to the fire fighter via legislation requiring same.

The second part of our appeal is to urge your consideration and support to keep funding programs of the United States Fire Administration directed at fire prevention through "public education." It is our understanding the "Public Education Division" of U.S.F.A. has been all but

The Honorable Doug Walgren
Page 2
March 15th, 1983

obliterated from the present administration. We cannot comprehend how a program as vital as this could fall by the wayside. In our County of nearly 400,000 people we have shown incredible results due to public education. Many of our local fire prevention/public education programs are a direct result of in-put assistance received from the Public Education Division of U.S.F.A. Fire deaths alone in 1981 in Westmoreland County stood at 13, in 1982 they dropped to 4 in that 12-month period. Our programs have been running hard since 1980. Seminars, conferences, institutes, etc. sponsored on a regional basis to indoctrinate local fire officials and organizations of the types and kinds of fire prevention/public education programs available from the U.S.F.A. is the answer. This answer will require funding! And let me make it perfectly clear, we in the active fire service today are going to pay our "fair share" for training and education. We do not expect any of this for nothing. If the Feds and U.S.F.A. make the programs available we will do our part.

There are many other areas we would like to address: residential sprinkler protection...mandatory smoke detection and alarm systems for all single family dwellings...fire safety in modular constructed mobile homes, etc., but time in this testimony does not permit us to do so.

We thank you for the opportunity to supply you with this information. We stand ready to serve you with additional data at your request backing up our presentation.

Kindest regards,

Jack W. Simon

Jack W. Simon
Director of Administration
County Liaison
Westmoreland County Firemen's
Association

JWS/eo

MAN-MADE FIBER PRODUCERS ASSOCIATION, INC.

1150 Seventeenth Street, N.W.
Washington, D.C. 20036
Telephone (202) 296-6508
Cable: FIBERASSOC–Telex: DC 89-2407-MMFPA

CHARLIE W. JONES
President

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COMMITTEE ON SCIENCE
AND TECHNOLOGY

March 18, 1983

The Honorable Don Fuqua
Chairman
Science and Technology Committee
House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

I am writing to express our concern about the fact that the 1984 federal budget contains no funds for the Center for Fire Research at the National Bureau of Standards (NBS).

Over the years, the Center for Fire Research has developed an outstanding reputation. It has been the center for development of meaningful and relevant test methods to determine overall combustion properties of many textile products.

The Center for Fire Research has made valuable contributions to a better understanding of the complex fire phenomenon and how materials burn. In addition, the Center has recently completed development of a laboratory test method for research purposes to determine toxicity of combustion products. The Bureau recognizes the limitations of this test and the need for continuing research to determine the relationship of the laboratory test methods to real fire situations.

The work of NBS has resulted in the general agreement among fire experts and industry that the most cost effective means of providing life safety and protection of property is the greater use of installed automatic sprinklers and early warning systems. The Center is continuing to more fully explore the applications of new sprinkler technology and cost effective installation of such systems in all types of occupancies.

We believe it is essential that these kinds of investigations be continued by the Center for Fire Research since the Bureau is looked upon by standard writing groups, code officials and fire service personnel to provide leadership, guidance and uniformity in providing meaningful standards concerning fire which is of national

Allied Fibers & Plastics Co.
American Cyanamid Co.
American Enka Co.
Amoco Fabrics Co.
Avtex Fibers Inc.
Badische Corp.
Celanese Corp.
Courtaulds North America Inc.
The Du Pont Co.
Eastman Chemical Products, Inc.
Hercules Incorporated
Hoechst Fibers Industries
Monsanto Textiles Co.
North American Rayon Corp.
Phillips Fibers Co.

interest. The Bureau is better equipped than the private sector to use all sources of information and review to insure the reliability of research programs and test methods addressing the fire phenomenon.

We hope that your Subcommittee will reinstate funding for 1984 for the Center for Fire Research. If you have additional questions concerning this subject, please let me know.

Sincerely yours,

CWJ/ls

NFPA
"Moving Mankind Toward Safety From Fire"

NATIONAL
FIRE PROTECTION
ASSOCIATION
INTERNATIONAL

Capital Gallery, Suite 220
600 Maryland Avenue, S.W.
Washington, D.C. 20024
(202) 484-8200
Telex No. 904024

March 21, 1983

Congressman Doug Walgren
Chairman
Science, Research and Technology
  Subcommittee
House Science and Technology Committee
2319 Rayburn House Office Building
Washington, D.C. 20515

Dear Congressman Walgren:

As you know, the National Fire Protection Association is strongly opposed to the elimination of the Center for Fire Research within the National Bureau of Standards. NFPA Vice President Martin E. Grimes testified before your Committee on March 16, 1983 concerning the NFPA opposition to this proposal.

The National Fire Protection Association would like to reiterate its position regarding the Center for Fire Research as provided in our statement for the Record of March 16, as your Committee discusses the National Bureau of Standards budget March 22 and 23.

For your information, I have enclosed a copy of the NFPA statement provided before your Committee on March 16. We appreciate very much your strong support regarding the continuation of the Center for Fire Research.

Sincerely,

Robert B. Smith
Director of Government Affairs

RBS/scy
Enclosure

EXECUTIVE OFFICE: BATTERYMARCH PARK, QUINCY, MASSACHUSETTS, U. S. A. 02269 • TELEPHONE (617) 328-9290 • TELEX 94-0720

The non-profit technical and educational organization: To promote the science and improve the methods of fire protection and prevention; to obtain and circulate information on these subjects and to secure the co-operation of its members and the public in establishing proper safeguards against loss of life and property by fire.

The Society of the
Plastics Industry, Inc.

605 14th Street, N.W.
7th Floor
Washington, D.C. 20005
(202) 828-0270

March 22, 1983

Honorable Doug Walgren
Chairman, Subcommittee on Science, Research and Technology
House Committee on Science and Technology
U.S. House of Representatives
2321 Rayburn House Office Building
Washington, D.C. 20515

Dear Representative Walgren:

The Society of the Plastics Industry is concerned about the deletion of funds for the National Bureau of Standards' Center for Fire Research in the agency's recently proposed budget for Fiscal Year 1984. The pioneering work the Center has performed in the area of fire technology in recent years has provided a sound basis for a better understanding of the hazards associated with combustion. This kind of research is essential to the continuing effort to reduce fire deaths in this country.

The plastics industry has been a long-standing active supporter of the programs conducted by the NBS Center for Fire Research. Although considerable fire technology research is conducted by industry and independent institutions, the Center possesses a research capacity that cannot be readily duplicated elsewhere. Its elimination would severely handicap efforts to improve fire safety in this country.

We urge the House Subcommittee on Science, Research and Technology to restore FY 84 funds to the NBS Center for Fire Research at a level that permits this invaluable work to continue.

Sincerely,

Lewis R. Freeman
Director
Federal Government Affairs

LRF/clw

cc: House Subcommittee on Science, Research and Technology members

Rogers & Wells
1737 H Street, N.W.
Washington, D.C. 20006
TELEPHONE (202) 331-7760
INTERNATIONAL TELEX 248439

200 PARK AVENUE
NEW YORK, N.Y. 10166
TELEPHONE (212) 878-8000
INTERNATIONAL TELEX 234493
DOMESTIC TELEX 710-581-2191

261 SOUTH FIGUEROA STREET
LOS ANGELES, CALIFORNIA 90012
TELEPHONE (213) 626-6900

110 WEST A STREET
SAN DIEGO, CALIFORNIA 92101
TELEPHONE (619) 239-1200
INTERNATIONAL TELEX 697842

19 WEST ELM STREET
GREENWICH, CONNECTICUT 06830
TELEPHONE (203) 869-6533

47, AVENUE HOCHE
75008-PARIS, FRANCE
TELEPHONE 763.11.00
INTERNATIONAL TELEX 290617

58 COLEMAN STREET
LONDON EC2R 8BE, ENGLAND
TELEPHONE 01.628.0101
INTERNATIONAL TELEX 884964

CABLE ADDRESSES
"YORKLAW" NEW YORK
"WALAW" WASHINGTON
"LALAW" LOS ANGELES
"DIEGOLAW" SAN DIEGO
"EURLAW" PARIS
"USLAW" LONDON

March 23, 1983

The Honorable
Doug Walgren
Chairman of the Subcommittee on
Science, Research and Technology
Committee on Science and Technology
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

Enclosed is the statement of our client, Allied Tube and Conduit Corporation, in support of restored funding for the Center for Fire Research at the National Bureau of Standards (the "NBS"). We ask that this statement be made a part of the record of the Subcommittee's authorization hearings on the NBS.

If further information would be of assistance to you, we would be pleased to provide it.

Very truly yours,

Eugene T. Rossides

Enclosure

allied
TUBE & CONDUIT
CORPORATION

March 22, 1983

STATEMENT OF ALLIED TUBE & CONDUIT CORPORATION

Submitted to the
SCIENCE, RESEARCH AND TECHNOLOGY SUBCOMMITTEE
of the
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

Allied Tube and Conduit Corporation wishes to register its strong exception to and serious concern over the Administration's proposed elimination of the Center for Fire Research at the National Bureau of Standards. This would be the result of the Administration's decision not to authorize any funds for the Center for Fire Research in the Commerce Department's budget for fiscal year 1984.

Allied manufactures and markets electrical conduit, sprinkler pipe, and a variety of other products made from steel. Allied is especially interested in minimizing the fire hazards associated with building materials.

The Subcommittee has heard and read the statistics regarding fire-related injuries and deaths; its members are aware that this country's record is among the worst in the industrialized world when it comes to preventing death, injury and property destruction by fire. There is a great deal of urgent work to do in this area -- and the Center is clearly one of the most important places to do it.

16100 SOUTH LATHROP HARVEY, ILLINOIS 60426 (312) 339-1610, CHICAGO 955-6000 TELEX 25-4352

Current projects of the Center include the design of smoke control systems, the development of fire safety evaluation systems, testing and development of residential sprinklers, fire modeling, and research regarding arson, heating appliance fires and basic combustion. The Center also operates a fire research grant program to encourage the development of scientists and engineers in fire research and safety, a fire research information center, and an annual conference on fire research, in addition to participating in voluntary standards organizations and in the international fire safety community.

One of the most complex and significant questions in fire safety research today involves the toxicity of smoke and gases given off by many of the materials that are used in today's building construction and furnishings. The Center is in the forefront of the research efforts that are urgently needed for us to appreciate fully the extent of this problem and to develop the most effective measures to deal with it.

In the mid-1970's, while perfecting a test methodology for residential smoke detectors (one of the most important fire-safety breakthroughs of the decade), the Center also determined that the possible lethal effects of toxic fumes emitted from the ever increasing number of synthetic materials that are finding their way into our modern-day construction and furnishings, warranted a major research effort on its part.

The gravity of this particular subject has recently been underscored by the rash of fire disasters in hotels and other high-density structures that we have seen in recent years.

The efforts of the Center have resulted, thus far, in the development of a test protocol that has raised serious questions about the toxicity of polyvinyl chloride and other polymeric materials relative to untreated wood. To be sure, there is a need for further refinement of this test protocol and for the development of an acceptable rating system for such building materials and furnishings. There are complex technical issues involved that clearly need the independent expertise of the Center. Last year, Congress registered its concern when, in December, it appropriated an additional $350,000 to enable the Center to continue this important research on combustion toxicity.

Just last month, the president of the Uniformed Fire Officers Association told New York State's Fire Prevention and Building Code Council that the use of plastics and other synthetic materials in high rise office buildings makes those structures "gigantic toxic time bombs. . . Should a fire strike," he said, "it would be disastrous. Even if . . . people could have escaped safely, the toxic fumes from burning plastics and other synthetics would kill them." Prophetically, on the very day these remarks were reported, 64 people died in a fire in Turin, Italy. United Press International reported the tragedy as follows:

> Poisonous fumes emitted by burning plastic seat covers turned a movie theater into a "spectacular gas chamber" that choked to death most of the 64 victims of the cinema blaze, investigators said . . .
>
> "There were no high tongues of flame that destroy everything in a brief space of time," Fire Chief Giuseppe Marini said. "But there was a great quantity of smoke containing not only anhydrous chemicals, carbon dioxide and ashes but also other poisonous gases produced by the decomposition of material from which the cinema furnishings were made."

Last November, toxic fumes from a fire in a single Mississippi jail cell killed 27 and injured 61 elsewhere in the building. The list of such disastrous episodes is an alarmingly long and steadily growing one. Suffice it to say there is mounting evidence and recognition that combustion toxicity is a major fire safety problem that needs the continued research focus of the Center.

Also, the Center's research efforts must not be abruptly halted because it is a research institution that all those who are involved with the complex problem of combustion toxicity have accepted as an objective, credible source of scientific knowledge in this area. That the consequences of toxicity research also will have a commercial impact on the many competing forms of construction and furnishing materials -- including steel and plastics -- is itself an important reason to safeguard the Center's acknowledged neutral expertise.

The Administration has rationalized its proposed elimination of the Center by suggesting that the private sector will, in one way or another, take up the Center's work. Just last week, however, this Subcommittee heard authoritative testimony to the contrary. One of the country's largest private-sector fire research organizations, Factory Mutual, noted that "the basic fire research effort of the nation consists almost entirely of the Center for Fire Research effort, some university programs supported by the Center for Fire Research, and our own effort. . . . If the Center for Fire Research disappeared, it is probable that our basic effort would disappear too." At the same hearings, the National Fire Protection Association testified that:

> The crucial and irreplaceable element that NBS brings to the fire safety community is credibility. Private funds doing the same research, just as well, could not have the same impact.

Scientific quality, practicality, objectivity and neutrality have been the hallmarks of the Center. There is simply no evidence that the private sector is inclined even to attempt to fill the vacuum that would be left in the area of basic fire research if the Center were to be eliminated.

The Administration also attempts to justify shutting down the Center on the basis that fire safety is more appropriately a matter for state and local governments. This claim misses the point. It is true that fire prevention, regulation and, of course, firefighting are primarily matters for local jurisdictions. The federal government, however, does have a significant role to play in assisting local jurisdictions with their work. For example, the U.S. Fire Academy instructs local firefighters in the latest methods of fire suppression. Last year, it was this institution that was targeted by the Administration for extinction. Congress rejected the attempt. This year, having lost last year's fight, the Administration has reversed its previous position by supporting the continued funding of the U.S. Fire Academy, but has focused on a new target, the Center. With this nation's fire safety record, both institutions provide essential federal support for effective local fire prevention and regulatory efforts and must, therefore, be continued.

To be sure, state and local governments already have focused on the problem of combustion toxicity and have undertaken their own efforts to deal with this subject. They will continue to do so and many more, no doubt, will be joining them in the future. It is, therefore, imperative that the resources and objectivity of the Center be available, when the need arises, to assist these local governments with their efforts to regulate responsibly in this area.

The previously mentioned involvement of the Center in the development of the smoke detector -- probably the single most important piece of fire-safety equipment in the average American home -- is illustrative of the assistance that the Center provides. Smoke detectors now are required by many local fire codes for many different structures, and they are encouraged in an increasing number of jurisdictions through differentiated fire insurance rates. A decade ago few American homes had such devices. That an estimated two-thirds of this country's households now have this inexpensive life-saving alarm is due, in large measure, to the work of the Center which developed the first universally accepted test methodology for certifying acceptable residential smoke detectors. This facilitated their acceptance into the mainstream of American life.

In sum, we urge the Subcommittee on Science, Research and Technology to restore the Center's budget authorization at its fiscal year 1983 level. As the Subcommittee is aware, the Science, Technology and Space Subcommittee of the Senate Committee on Commerce held hearings on the Center and related topics exactly one month ago on February 22. Indeed, many of the witnesses now appearing before this Subcommittee also were present at the Senate Subcommittee hearings. With the exception of those witnesses whose job it is to present the Administration's view, praise and support for the Center has been unanimous. Senator Gorton already has introduced a bill that would restore the Center's budget authorization. We hope similar action on the House side will result from this Subcommittee's inquiry.

GENERAL ELECTRIC

CORPORATE
RESEARCH AND
DEVELOPMENT

NERAL ELECTRIC COMPANY, RESEARCH AND DEVELOPMENT CENTER, P.O. BOX 8
SCHENECTADY, NEW YORK 12301, Phone (518) 385-2211

Building K-1, Room 5A50
March 22, 1983

Honorable Mr. Doug Walgren
Chairman, Committee on Science
and Technology
U.S. House of Representatives
Washington, D.C. 20515

Dear Congressman Walgren:

I am writing on behalf of the Center for Fire Research (CFR) of the National Bureau of Standards. It has recently come to my attention that Congressional hearings are now in progress to determine whether the research programs of the Center should be curtailed or even eliminated. Over the past 10 years, I, and people in my group, have been involved with the question of the flammability of plastics, dealing with both the chemical and testing aspects of this problem. Throughout this period, I have felt that CFR has been the premier laboratory in this country, and perhaps the world, in the areas of fire testing, fire modeling, fire safety, and exploratory fire research.

In recent years, I have been a member of National Research Council Evaluation Panel for the CFR and have had an opportunity to review their current programs and compare their work with that of other private and academic laboratories. This exposure only reinforced my high opinion of the Center.

In the past few years, there has been a steady decline in fire research in this country even though the USA still ranks number one in the world in fire deaths and fire losses. The only hope of changing this record is to maintain the viability of the Center of Fire Research.

Sincerely,

Arnold Factor

Arnold Factor
CHEMICAL LABORATORIES

AF:cap

CRI The Carpet and Rug Institute, Box 2048, Dalton, Georgia 30720 (404) 278-3176

Ronald E. VanGelderen
President

April 4, 1983

The Honorable Dcn Fuqua
House Committee on Science and Technology
2321 Rayburn House Office Building
Washington, D.C. 20515

Dear Sir:

The Carpet and Rug Institute recommends that full funding for the National Bureau of Standards Center for Fire Research be reinstated.

Responsible fire research is essential. NBS has earned a reputation over the years which garners acceptance with objectivity. Presently the problems of fire safety are being confused by the myriad of testing laboratories, consultants and well-meaning consumer advocates. The fire research which is being conducted by industry and academia is frequently fragmented, lacks equipment and expertise, and cannot compare to the concentrated effort which has taken place at the NBS.

Although we are basically for "less government," we feel that one of the most important functions of the NBS is its contribution in the area of fire safety, toxicity, etc. The valuable research at the Center for Fire Research has been a factor in leading the decline of fire deaths and their input is needed to continue the decline. It is difficult to place a dollar value on an individual's life, but a 25 percent decline in the past decade would appear to more than justify the money which has been appropriated for fire research.

These issues are very much in the public's eye right now and we feel that it would be ill-timed to discontinue funding this very important function. In fact, the scope of involvement should be expanded to include fires in homes. Most lives are lost in residential dwellings but little research is being conducted to reduce this hazard. Fires in public buildings or high density occupancy buildings receive all the notoriety, yet the residential fire hazard problem needs far more attention.

Our industry has been particularly impressed by the Center for Fire Research when protocols were developed in coming up with acceptable standards for carpet flammability - a serious issue ten years ago and now a requirement taken for granted by the public. It is an example of responsible action by NBS and the Center for Fire Research. We

APPENDIX III

Center for Building Technology

Statements and Letters

AMERICAN ASSOCIATION OF STATE HIGHWAY
AND TRANSPORTATION OFFICIALS

HENRY GRAY, President
Director
Arkansas State Highway and
Transportation Department

FRANCIS B. FRANCOIS
Executive Director

February 18, 1983

The Honorable Doug Walgren, Chairman,
House Subcommittee on Science & Technology
117 Cannon House Office Building
Washington, D.C. 20515

Dear Congressman Walgren:

I understand your Subcommittee has scheduled hearings and plans to take up the question of new authorization for the National Bureau of Standards in the near future. I further understand that the Administration's FY 1984 budget request for the NBS calls for, among other things, the elimination of the Center for Building Technology. It is about this last matter that I am writing to you.

The American Association of State Highway and Transportation Officials (AASHTO) is the national association of state departments of highways and transportation. Among their duties dealing with all transportation modes, the state agencies comprising AASHTO are responsible for planning, designing, constructing and operating the nation's principal system of highways. An important part of that responsibility is an adequate program of quality assurance with respect to the materials used in the construction and maintenance of our highways. This quality assurance role is accomplished through a materials division in each of the departments, each of which operates one or more materials laboratories to conduct the necessary testing and evaluation.

Recognizing the importance of consistency in such materials testing across the country, the AASHTO Materials Reference Laboratory (AMRL) was established in 1965 under an agreement with the National Bureau of Standards. The purpose of the AMRL was and is to provide a quality assurance program for the state materials laboratories themselves. This has been accomplished through two programs, both of which now are done by this AMRL under the overall auspices of the National Bureau of Standards and its Center for Building Technology. These are:

- o A sample reference program wherein test results from participating laboratories on soil and asphalt samples prepared from a central source are statistically evaluated for consistency, and
- o A physical inspection of the state laboratories and their equipment, conducted on a rotation cycle of approximately 30-months duration.

EXECUTIVE OFFICE 444 N. Capitol Street, N.W. Suite 225, Washington, D.C. 20001 Telephone (202) 62

While it is managed by the NBS, the costs of the AMRL program have been borne principally by the state departments involved, with assistance from the Federal Highway Administration, on billings made to AASHTO by the NBS. Other financial resources have been received through fees paid by outside laboratories, who have chosen to participate. None of the needed resources have been provided from funds appropriated for NBS, since the NBS bills us for all the costs involved.

With the perspective of 18 years hindsight, the AMRL program has indeed been a success. The state highway and transportation departments have been afforded a sound, well managed mechanism to assure the quality and consistency of their materials laboratories and attendant procedures. While there has been no financial benefit to the states resulting from the connection with NBS, because of their billings to us, we feel their involvement has been pivotal to our success for several reasons. Among these are the prestige and clear unassailability attendant to the involvement of, and objective management by, the nation's principal scientific measurement agency, its NBS. Another is the distinct absence of a federal regulatory role; the service provided through the NBS merely provides a basis on which the states may regulate themselves. We fear these important factors could be lost if the proprosal for elimination of the Center for Building Technology is approved. That there would be some other unit within NBS to which AMRL could be attached seems problematical at best, and very likely impractical.

There is another similar program also now in jeopardy by such an elimination. This is the Cement and Concrete Reference Laboratory (CCRL), sponsored through NBS in virtually an identical fashion by the American Society for Testing Materials (ASTM). Our state highway and transportation departments avail themselves of this service coincidentally with that afforded by AMRL, and compensate the CCRL program through fee payments. These two programs are closely related in that they each serve many of the same clients and are now managed by the same NBS employee. Thus, many of the comments on AMRL, above, are equally applicable to CCRL.

Enclosed with this letter are two previously prepared documents which provide further details on both AASHTO and the AMRL program. Beyond that, I would be pleased to provide any additional information you may wish. Simply call me or my Deputy Director, Mr. David Hensing, at 624-5800.

Very truly yours,

Francis B Francois

Francis B. Francois
Executive Director

Enclosure
FBF:DH:wss

cc: The Honorable Don Fuqua, Chairman
House Subcommittee on Science and Technology

KEY OFFICIALS

Clements

JOHN A. CLEMENTS
Commissioner
New Hampshire Department
of Public Works & Highways
is the 1982
AASHTO President

Gray

HENRY GRAY
Director of Highways &
Transportation
Arkansas Highway &
Transportation Department
is the 1982
AASHTO Vice President

HISTORY: Founded in 1914 to represent state highway organizations, it was reorganized in 1974 to respond to increasing needs of highway and transportation agencies in the several transportation modes in addition to highways. In 1976, the committee structure was further revised to identify modal standing committees.

PURPOSE: To develop and improve methods of administration, planning, research, design, construction, maintenance, and operation of facilities for efficient and effective transportation of persons and goods in support of national goals and objectives.

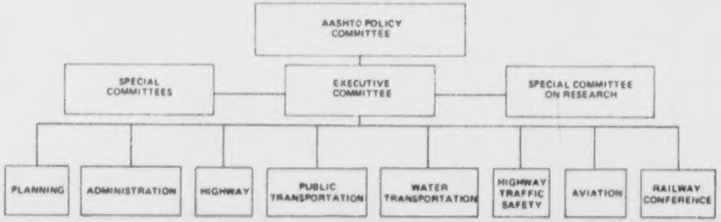
☆ ☆ ☆

Active Members: Duly constituted heads and other chief directing officials of the various State highway and transportation agencies.

Affiliate Members: Alberta, Guam, Manitoba, New Brunswick, Northwest Territories, Nova Scotia, Ontario, Saskatchewan, Virgin Islands, Marianas.

Associate Member: New Jersey Turnpike Au-thority, Metropolitan District Commission

AASHTO COMMITTEE STRUCTURE



WHAT IS AASHTO?

AASHTO is the American Association of State Highway and Transportation Officials representing 52 member departments, including the District of Columbia and Puerto Rico, to foster development, operation and maintenance of an integrated national transportation system.

The National office is located at:

444 N. Capitol St., N.W.
Suite 225
Washington, D.C. 20001
Telephone: AC 202 624-5800

KEY EXECUTIVE STAFF

FRANCIS B. FRANCOIS
Executive Director
DAVID J. HENSING
Deputy Director
BILLY K. HIGGINS
Legislative Liaison

Assistants to the Director:

WILLIAM T. DRUHAN
JOHN L. HEWITT
WM. DAVID LEE
PHYLLIS G. WEISS

STATE HIGHWAY AND TRANSPORTATION DEPARTMENT OFFICES

ALABAMA
Highway Department
Montgomery, AL 36130
(205) 832-5440

ALASKA
Dept. of Transportation
& Public Facilities
Pouch Z
Juneau, AK 99811
(907) 465-3900

ARIZONA
Dept. of Transportation
206 S. 17th Ave.
Phoenix, AZ 85007
(602) 261-7011

ARKANSAS
State Highway &
Transportation Dept.
State Highway Dept. Bldg
P.O. Box 2261
Little Rock, AR 72203
(501) 569-2000

CALIFORNIA
Dept. of Transportation
1120 N Street
Sacramento, CA 95814
(916) 445-4616

COLORADO
Department of Highways
4201 E. Arkansas Ave.
Denver, CO 80222
(303) 757-9201

CONNECTICUT
Dept. of Transportation
24 Wolcott Hill Road
Wethersfield, CT 06109
(203) 566-5280

DELAWARE
Dept. of Transportation
Highway Admin. Center
P.O. Box 778
Dover, DE 19901
(302) 736-4303

DISTRICT OF COLUMBIA
Dept. of Transportation
Prosidential Building
415 12th Street, N.W.
Washington, D.C. 20004
(202) 727-1000

FLORIDA
Dept. of Transportation
Haydon Burns Building
605 Suwannee Street
Tallahassee, FL 32301
(904) 488-1234

GEORGIA
Dept. of Transportation
2 Capitol Square
Atlanta, GA 30334
(404) 656-5206

HAWAII
Dept. of Transportation
869 Punchbowl Street
Honolulu, HI 96813
(808) 548-3205

IDAHO
Idaho Transportation Dept.
3311 W. State Street
P.O. Box 7129
Boise, ID 83707
(208) 334-3664

ILLINOIS
Dept. of Transportation
2300 S. Dirksen Parkway
Springfield, IL 62764
(217) 782-5597

INDIANA
Dept. of Highways
State Office Building
100 N. Senate Avenue
Indianapolis, IN 46204
(317) 232-5526

Dept. of Transportation
143 W. Market Street
Suite 300
Indianapolis, IN 46204
(317) 232-1470

IOWA
Dept. of Transportation
800 Lincoln Way
Ames, IA 50010
(515) 296-1101

KANSAS
Dept. of Transportation
State Office Building
Topeka, KS 66612
(913) 296-3461

KENTUCKY
Dept. of Transportation
State Office Building
Frankfort, KY 40622
(502) 564-4890

LOUISIANA
Dept. of Transportation
&Development
P.O. Box 44245, Capitol Sta
Baton Rouge, LA 70804
(504) 342-7500

MAINE
Dept. of Transportation
State Office Building
Augusta, ME 04330
(207) 289-2551

MARYLAND
Dept. of Transportation
P.O. Box 8755
Balt.-Wash. Int'l Airport
Baltimore, MD 21240
(301) 859-7333

MASSACHUSETTS
Dept. of Public Works
100 Nashua Street
Boston, MA 02114
(617) 727-4800

MICHIGAN
Dept. of Transportation
State Transportation Bldg.
425 West Ottawa
P.O. Box 30050
Lansing, MI 48909
(517) 373-2114

MINNESOTA
Dept. of Transportation
Transportation Building
John Ireland Blvd
St. Paul, MN 55155
(612) 296-3131

MISSISSIPPI
State Highway Department
Woolfolk State Office Bldg.
P.O. Box 1850
Jackson, MS 39205
(601) 354-6034

MISSOURI
Highway & Transportation
Department
Highway & Transp. Bldg
P.O. Box 270
Jefferson, MO 65102
(314) 751-2551

MONTANA
Department of Roads
2701 Prospect Ave.
Helena, MT 59620
(406) 449-2482

NEBRASKA
Department of Roads
South Jct. of US 77 & N2
P.O. Box 94759
Lincoln, NE 68509
(402) 477-6012

NEVADA
Dept. of Transportation
1263 S. Stewart Street
Carson City, NV 89712
(702) 885-5440

NEW HAMPSHIRE
Dept. of Public Works
& Highways
John O. Morton Bldg.
85 Loudon Road
Concord, NH 03301
(603) 271-3734

NEW JERSEY
Dept. of Transportation
1035 Parkway Avenue
Trenton, NJ 08625
(609) 292-3346

NEW MEXICO
State Highway Dept.
State Highway Dept. Bldg
P.O. Box 1149
Santa Fe, NM 87503
(505) 983-0100

NEW YORK
Dept. of Transportation
1220 Washington Avenue
Albany, NY 12232
(518) 457-4422

NORTH CAROLINA
Dept. of Transportation
P.O. Box 25201
Raleigh, NC 27611
(919) 733-2520

NORTH DAKOTA
State Highway Dept.
State Highway Bldg
Capitol Grounds
Bismarck, ND 58505
(701) 224-2500

OHIO
Dept. of Transportation
25 S. Front Street
Columbus, OH 43216
(614) 466-7170

OKLAHOMA
Dept. of Transportation
200 N.E. 21st Street
Oklahoma City, OK 73105
(405) 521-2631

OREGON
Dept. of Transportation
Transportation Building
Salem, OR 97310
(503) 378-6388

PENNSYLVANIA
Dept. of Transportation
Transp. & Safety Bldg.
Commonwealth & Forster Sts.
Harrisburg, PA 17120
(717) 787-2121

PUERTO RICO
Dept. of Transportation
& Public Works
P.O. Box 41269
San Juan, PR 00940
(809) 726-5151

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Agana, GU 96910
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Canada B3J 2N2

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Canada M3M 1J8
(416) 965-2101

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Regina, Saskatchewan
Canada S4P 3V5

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Dept. of Public Works
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(809) 774-2070

ASSOCIATE MEMBERS:

NEW JERSEY TURNPIKE AUTH.
New Brunswick, NJ 08903

METROPOLITAN DISTRICT COMM.
Boston, MA 02108

Corrected Copy
Jan 1982

AASHTO MATERIALS REFERENCE LABORATORY
AT THE
NATIONAL BUREAU OF STANDARDS
WASHINGTON, D. C. 20234

SPONSORED BY
SUB-COMMITTEE ON MATERIALS
AMERICAN ASSOCIATION OF STATE HIGHWAY
AND TRANSPORTATION OFFICIALS

SIXTEENTH STATUS REPORT
FOR THE
AASHTO MATERIALS REFERENCE LABORATORY

Introduction

The AASHTO Materials Reference Laboratory (AMRL) was established at the National Bureau of Standards on October 1, 1965. This report, which introduces developments in the period from August 1, 1980 to July 30, 1981, into the record, constitutes the sixteenth progress report to the sponsoring AASHTO Subcommittee on Materials.

Functions of the AMRL

The principal functions of the AASHTO Materials Reference Laboratory are presently considered to be (1) Inspection of apparatus and procedures used in the testing of aggregates, soils, bituminous materials, bituminous mixtures, hydraulic cements, and hydraulic cement concretes; and (2) Distribution of proficiency test samples. The principal complementary activities are (1) Study of testing problems, and (2) Participation in the work of technical committees.

Inspection of Testing Laboratories

Plans for the inspection of aggregate, soils, and bituminous testing facilities stipulate that the central testing laboratories operated by the sponsors be inspected by the AASHTO Materials Reference Laboratory at intervals of less than two years. Inspections of the cement and concrete testing facilities in these laboratories are performed by the Cement and Concrete Reference Laboratory during each CCRL inspection tour of the United States and Canada on a fee basis, with the fees being paid from AMRL funds. The CCRL service covers the testing of reinforcing bars as well as the testing of cements and concretes.

The number of physical tests for construction materials being covered by the combined AMRL-CCRL inspections is presently as follows:

Aggregates	12	Cement	12
Soils	17	Concrete	8
Bituminous Materials	12	Re-Bars	2
Emulsified Asphalts	9	Miscellaneous	6
Bituminous Mixtures	10	Total	88

Some sixteen related specifications for testing apparatus are being referenced in connection with this coverage.

The AMRL has now conducted eleven tours of the cooperating laboratories and has a twelfth tour underway. The record of participation in the completed tours is as follows:

Tour Number	1	2	3	4	5	6	7	8	9	10	11
Type of Laboratory:											
State	52	52	52	52	54	57	56	60	55	53	56
Federal	3	4	6	6	8	6	9	8	7	8	7
Miscellaneous	--	--	--	--	--	8	3	0	0	0	4
TOTALS	55	56	58	58	62	71	68	68	62	61	67

This tabulation reflects the fact that a few private laboratories availed themselves of the consulting services of the AMRL in Tours 6, 7, and 11.

Some of the state laboratories visited in recent tours have been branch laboratories. The fee schedule for these inspections has been as follows:
(1) Inspection of facilities for testing bituminous materials, or bituminous mixtures (including aggregates), or soils..............................$500 (each)
(2) Inspection of two facilities at one location........$700

It is expected that some private laboratories will be visited during the twelfth tour. The fee schedule for such inspections will be:

1. Soils Laboratories
    a. Inspection of test apparatus..............................$4150
    b. Inspection of test apparatus and procedures................ 8300

2. Bituminous Laboratories
    a. Aggregates
        (1) Inspection of test apparatus..........................$1300
        (2) Inspection of test apparatus and procedures........... 2600
    b. Bituminous Materials
        (1) Asphalt Cements: Inspection of test apparatus........$ 650
            Inspection of test procedures....... 650
        (2) Emulsified Asphalts: Inspection of test apparatus.... 650
            Inspection of test procedures... 650
    c. Bituminous Concrete
        (1) Inspection of test apparatus..........................$ 750
        (2) Inspection of test apparatus and procedures........... 2600

Inspections of private laboratories are to be conducted in accordance with AASHTO standards. Acceptance of requests will be limited to those that can be handled with the present staff and allocated facilities.

Extension of the inspection services to private laboratories created a need for a brochure describing the work of the AMRL. NBS Letter Circular No. 1122 entitled "AASHTO Materials Reference Laboratory" has been developed by O. W. McIntosh and J. R. Dise to satisfy that need.

Proficiency Testing

The Proficiency Testing Program of the AASHTO Materials Reference Laboratory was implemented in March 1966. Since that time 40 pairs of bituminous reference samples, 31 pairs of soil reference samples, 26 pairs of aggregate reference samples, and 7 pairs of bituminous concrete reference samples have been distributed.

All four programs are open to any interested laboratory that wishes to participate. New applications are accepted on a "when and if available" basis in order to maintain a workable balance between supply and demand.

Each sponsor of the AMRL is entitled to receive one single sample or one pair of samples on each scheduled distribution without charge. Charges for additional samples to an individual sponsor or charges for samples furnished to private laboratories are made in keeping with the fee schedule established by the Subcommittee on Materials, as described herein.

A. Bituminous Reference Sample Program

Pairs of samples are customarily distributed in March, June, and September. The March and September samples are asphalt cement. The June samples are cutback asphalts. The record of participation in the program is as follows:

NUMBER & CLASSIFICATION OF LABORATORIES
RECEIVING BITUMINOUS REFERENCE SAMPLES

Year Sample No.	1966 1-4	1968 9-12	1970 17-20	1971 21-24	1973 29-35	1976 47-52	1978 59-64	1979 65-70	1980 71-76	1981 77-80
Classification:										
State Highway	52	59	66	66	66	79	79	76	66	64
Federal	1	3	6	8	7	7	8	7	8	9
Commercial	--	--	--	29	14	10	7	9	13	14
Producer	--	4	4	18	24	21	28	25	31	34
Miscellaneous	--	--	--	2	3	4	5	6	6	8
Total	53	66	76	123	114	121	127	123	124	129

B. Aggregate Reference Sample Program

Pairs of samples are customarily distributed in April and October. The April samples are of fine aggregate. The October samples are of coarse aggregate. The sample shipment record is as follows:

Year	Sample No.	Number Shipped
1968	1-2	57
1969	3-6	62
1970	7-8	62
1970	9-10	81
1971	11-14	62
1972	15-18	92
1973	19-22	79
1974	23-26	94

Year	Sample No.	Number Shipped
1975	27-30	109
1976	31-34	115
1977	35-38	115
1978	39-42	121
1979	43-44	132
1979	45-46	143
1980	47-48	147
1980	49-50	144
1981	51-52	145

Samples 9, 10, 15, 16, 17, and 18 were sent to members of ASTM Subcommittee C09.03.05 for use in the development of data on which precision statements for selected methods of test for aggregate (ASTM Designations: C29, C88, C117, C127, C131, and C135) might be based. The general distribution of samples to all interested laboratories commenced with Samples 35 and 36.

C. Soil Reference Sample Program

Pairs of samples are customarily distributed in February and August. The shipment record is as follows:

Year	Sample No.	Number Shipped	Year	Sample No.	Number Shipped
1967	1-2	52	1976-78	41-52	93
1967-69	3-10	56	1979	53-54	100
1969-72	11-26	61	1979	55-56	107
1973	27-32	75	1980	57-58	167
1974	33-36	83	1980	59-60	170
1975	37-38	88	1981	61-62	196
1975	39-40	93			

It is anticipated that some of the data from the Soils Reference Sample Programs will be used in the preparation of precision statements for selected AASHTO and ASTM methods of test. Distribution of samples to private laboratories commenced in 1979 with Samples 55 and 56.

D. Bituminous Concrete Reference Sample Program

Individually batched, experimental pairs of Bituminous Concrete Reference Samples were distributed in April 1974 and May 1975. The results indicated that such samples are suited for use in a reference sample program.

A third experimental pair of samples, taken from material provided by a supplier of paving mixtures, was distributed in December 1975. The data from these tests were made available to ASTM Subcommittee D04.25 for possible use in the development of precision statements for selected methods of test for bituminous mixtures.

In consideration of the success of these experiments, a continuing program providing for the distribution of one pair of individually batched samples each year was implemented for the central laboratories operated by the sponsors of the AMRL in December 1977. General distribution of samples to all interested laboratories commenced in December 1979. The current registration is 87.

E. Cement and Concrete Reference Samples

Since July 1965 the Cement and Concrete Reference Laboratory has been sending two pairs of Portland Cement Reference Samples per year to 50 highway laboratories, and since November 1971 has been sending two pairs of Concrete Reference Samples to between 50 and 60 laboratories. In March 1978 the annual distribution of a pair of Blended Cement Reference Samples to interested highway/transportation laboratories was implemented. The CCRL has been paid for these services from AMRL funds.

F. Miscellaneous

The prescribed fees for the reference sample programs are as follows:

1. Bituminous Reference Sample Program (Annual Subscription)	
a. Two pairs of test samples of asphalt cement distributed at six month intervals	$100
b. One pair of test samples of cut-back asphalt	50
c. All of the above	150
2. Bituminous Concrete Reference Sample Program (Annual Subscription)	
a. One pair of test samples	$100
3. Aggregate Reference Sample Program (Annual Subscription)	
a. One pair of test samples of coarse aggregate	$ 75
b. One pair of test samples of fine aggregate	75
c. All of the above	150
4. Soil Reference Sample Program (Annual Subscription)	
a. Two pairs of test samples distributed at six month intervals	$130

Continuing efforts are being made to develop new participants for the various programs. As a consequence, registrations are increasing.

Beginning with Soils Samples No. 57 and No. 58, each participating AASHTO laboratory has been supplied with Laboratory Performance Charts as part of its personalized final report on each round of testing. It is believed that this was an important advancement of the AMRL reference sample programs.

Beginning in 1980, special compilations of AMRL reference sample data have been prepared and forwarded to cognizant Technical Section Chairmen as information of possible value to them.

A variety of special machinery is needed to carry the reference sample programs forward. In recent weeks a 60 yd^3 twin shell blender has been delivered and put into service. This new blender greatly simplifies the preparation of cement reference samples and substantially extends the ability of the AMRL to supply soils reference samples.

Study of Testing Problems

During the first fourteen years of operation, studies of testing problems were directed primarily to the development of information to support the inspection and proficiency testing programs. Work of this nature was also carried forward in the past year.

Beginning in 1980, at the request of the National Engineering Laboratory of the National Bureau of Standards, steps were taken toward the development of a cooperative working relationship with the Geotechnical Engineering Group of the NBS Center for Building Technology to carry out investigations aimed at the advancement of soils testing technology.

Also beginning in 1980, the AMRL has been cooperating with Technical Section 5a in the development of a procedure by which equipment used by the states in evaluating the performance of friction testing units can be checked for conformance to applicable specification requirements during on-site inspections. In keeping with this assignment, AMRL personnel met with Task Group 79-1 in Washington in January 1980 and in January 1981, and Mr. O. W. McIntosh visited the calibration centers in Ohio and Texas. Recently Mr. A. J. Stocker, Highway Safety Research Center, Texas Transportation Institute, visited the AMRL in Gaithersburg. Considerable literature has been collected and the inspectors have been making familiarization observations of trailers in recent inspections.

For the record it is noted that the research work described in Building Science Series 28 on "Exploratory Studies of Early Strength Development in Portland Cement Pastes and Mortars" by R. L. Blaine and L. A. Tomes was sponsored by the AMRL. Also, that Blaine carried out some special investigation of the characteristics of testing sands under AMRL sponsorship.

Committee Activities

The AMRL staff has continued to be actively involved in the work of standards committees. Current activities include participation in and contribution to the endeavors of ASTM Committees C-1, C-9, D-14, D-18, E-28, and E-41; and ACI Committee 116 on Nomenclature. One noteworthy product of these undertakings was the publication of the second edition of SP-19 Cement and Concrete Terminology by the American Concrete Institute in 1978. The AMRL had made substantial contributions to the development of this publication.

In particular, the staff endeavors to be responsive to the needs and interests of the Subcommittee on Materials, and in 1981 provided the fifteenth list of comments on the AASHTO standards to the Secretary for appropriate distribution.

Notable Events

Talks on the work of the AASHTO Materials Reference Laboratory were presented at the Second and Third AASHTO National Transportation Executive Seminars in Fredericksburg, Virginia in May 1978 and May 1979. Also, at a workshop entitled "Evaluation of Testing Laboratories by Federal Agencies" held at the National Bureau of Standards on March 7, 1978.

The Fifteenth Anniversary of the AMRL was nicely celebrated at the meeting of the AMRL Monitoring Council in Nashville, Tennessee on August 11, 1980. Later, on November 24, in a special ceremony at the U.S. Capitol, the AMRL was presented with an AASHTO Certificate of Commendation by Senator Jennings Randolph to commemorate this important milestone. In addition, the January 1981 edition of the magazine AASHTO presented a historical article by Garland Steele entitled "The AASHTO Materials Reference Laboratory (AMRL) Fifteen Years of Service."

Administrative Information

A. Sponsorship

During the first four years of operation, financial support for the AASHTO Materials Reference Laboratory was provided by the 52 U.S. highway/transportation departments and the Federal Highway Administration. In the fifth year, the initial sponsors were joined by the U.S. Forest Service which per special agreement, pays an annual amount equal to the per State assessment for each of its laboratories participating in the program. In the past ~~fifteenth~~ sixteenth year, money was received from ~~59~~ 51 of the 52 highway/transportation departments, from the Federal Highway Administration, and from ~~at least two~~ three sponsoring Forest Service laboratories.

In the period from October 1, 1965 to September 30, 1978, the AMRL operated as an NBS program supported by outside agency funds obtained through the American Association of State Highway and Transportation Officials. On October 1, 1978, conversion to an NBS Research Associate Program sponsored by AASHTO was implemented. That conversion is now essentially completed.

B. Staff

On August 1, 1980 the staff consisted of J. R. Dise (Manager), O.W. McIntosh (Assistant Manager); R. W. Dickson (Senior Bituminous Engineer); M. R. Brockman (Senior Soils Engineer); W. C. Grooms, D. A. Savage, B. H. Smith and Herbert Wechsler (Inspectors); P. A. Spellerberg (Engineering Technologist, supervising the Reference Sample Programs); M. A. Madigan (Engineering Technician); and Mrs. Katherine Panagos and Miss Theresa Shankle (Secretaries)

The following changes occurred during the year:

September 15--M. T. Stains was employed as an Engineering Aid
March 6--W. C. Grooms resigned
April 17--M. A. Madigan resigned
June 15--E. H. Reasner was employed as an Inspector-Trainee
June 19--Miss Shankle resigned.

The AMRL Staff Plan provides for a total of 14 positions, 11 of which are now filled. The vacant positions are those of the Engineering Technician and two Secretaries. It is anticipated that Mr. Stains will become the Engineering Technician when a new Engineering Aid is employed and that one of the open Secretarial positions will be filled as of August 3. The other secretarial position is for a part-time worker and is to be left open indefinitely.

C. Administrative Support From AASHTO Headquarters

The AMRL is now receiving substantial administrative support from AASHTO Headquarters, and the Treasurer of AASHTO. In particular, it is noted that all sponsorship payments, all fees for special inspections, and all fees for reference samples sent to branch transportation or private laboratories are handled by the two offices. This is a substantial task. Particular appreciation is extended to Mrs. Donna Hancock, AASHTO Bookkeeper, and Mrs. Mariann Humphreys, Administrative Assistant to Mr. Francois, for their important contributions to this effort.

UNIVERSITY OF COLORADO, BOULDER
Environmental Design Division
College of Design and Planning

March 4, 1983

Representative Don Fuqua
Chair, Committee on Science and Technology
2321 Rayburn Office Bldg.
Washington, D.C. 20515

Dear Representative Fuqua;

As a member of the Consultative Council of the National Institute of Building Sciences, I receive the regular newsletter of NIBS. The last issue brought to my attention the very disturbing information that the FY 1984 Budget Request of the current administration contains no funding for the Center for Building Technology within the National Bureau of Standards.

I want you to know that, from my situation as an academic, and former full-time practitioner in architecture, I am opposed to this cut-back. I also make this statement as a member of NIBS's Committee on a National Housing Technology Research Plan, although of course I speak for myself and do not pretend to represent the committee's position, or NIBS's.

What I am saying is that in my view, the CBT has performed a productive mission, and can continue to do so. My position is also that rather than cutting back this section of NBS, there ought to be a serious revitalization of this component of the private-public partnership in building technology research.

Most other advancing countries, when it comes to building technology research (defined widely as the multiple processes that bring the built environment into being and use and transformation) do a more thorough and clearly articulated job of supporting research that the private sector cannot reasonably do. This could be because of the controversial nature, the research, the question of liability, inter-industry jurisdictorial problems, high capital costs, and so on. Sweden, Germany and Japan are examples of creative partnerships that produce innovative and socially appropriate work in building technology.

I believe that cutting out funding for CBT is wrong, and that it is moving in exactly the wrong direction. I would like you to support an effort to refund CBT and to do so at a higher appropriation level whose aim is to reinvigorate the role of the public investment in the quality of everyday built environment.

I would appreciate hearing from you on this matter, including suggestions about others to whom I can address this concern.

Sincerely,

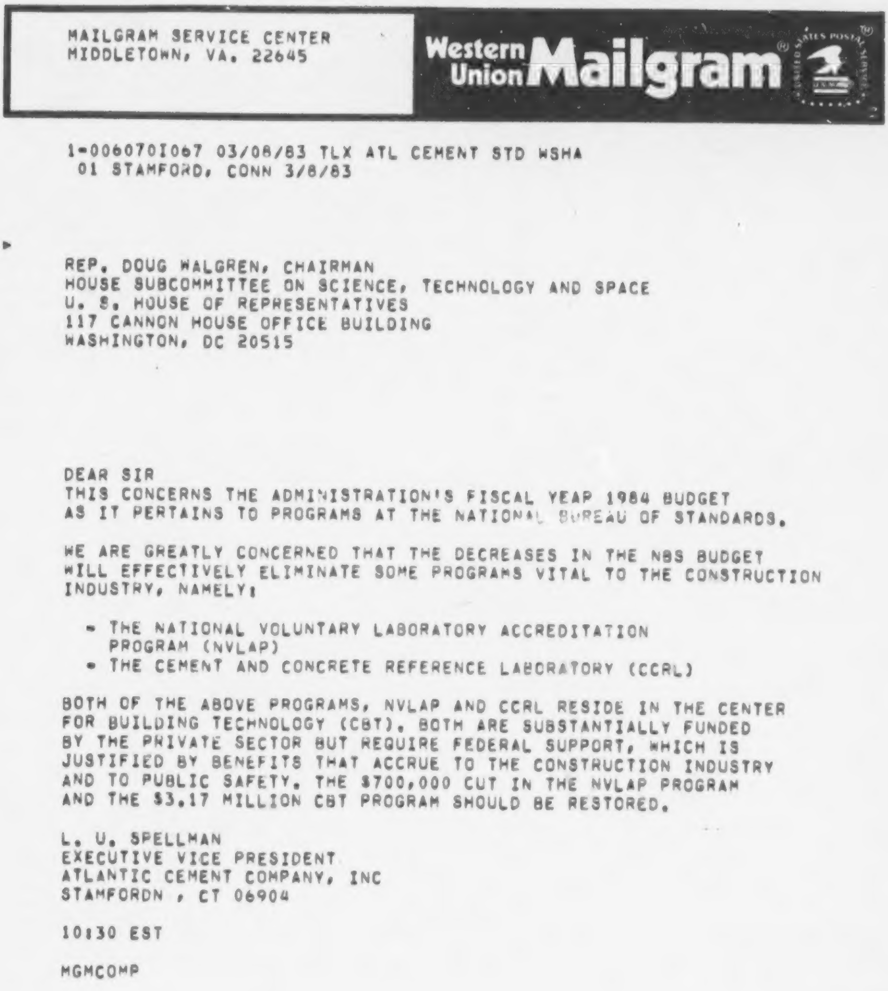
Stephen Kendall

Stephen Kendall
Assistant Professor, NIBS Consultative Council

cc: Frank Matzke, Vice President
Technology & Programs, National Institute of Building Sciences

SK:ss

Environmental Design Building • Campus Box 314 • Boulder, Colorado 80309 • (303) 492-7711



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REP. DOUG WALGREN, CHAIRMAN
HOUSE SUBCOMMITTEE ON SCIENCE, TECHNOLOGY AND SPACE
U. S. HOUSE OF REPRESENTATIVES
117 CANNON HOUSE OFFICE BUILDING
WASHINGTON, DC 20515

DEAR SIR
THIS CONCERNS THE ADMINISTRATION'S FISCAL YEAR 1984 BUDGET AS IT PERTAINS TO PROGRAMS AT THE NATIONAL BUREAU OF STANDARDS.

WE ARE GREATLY CONCERNED THAT THE DECREASES IN THE NBS BUDGET WILL EFFECTIVELY ELIMINATE SOME PROGRAMS VITAL TO THE CONSTRUCTION INDUSTRY, NAMELY:

- THE NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP)
- THE CEMENT AND CONCRETE REFERENCE LABORATORY (CCRL)

BOTH OF THE ABOVE PROGRAMS, NVLAP AND CCRL RESIDE IN THE CENTER FOR BUILDING TECHNOLOGY (CBT). BOTH ARE SUBSTANTIALLY FUNDED BY THE PRIVATE SECTOR BUT REQUIRE FEDERAL SUPPORT, WHICH IS JUSTIFIED BY BENEFITS THAT ACCRUE TO THE CONSTRUCTION INDUSTRY AND TO PUBLIC SAFETY. THE $700,000 CUT IN THE NVLAP PROGRAM AND THE $3.17 MILLION CBT PROGRAM SHOULD BE RESTORED.

L. U. SPELLMAN
EXECUTIVE VICE PRESIDENT
ATLANTIC CEMENT COMPANY, INC
STAMFORDN , CT 06904

10:30 EST

MGMCOMP

IES

Illuminating Engineering Society of North America

Rogers B. Finch, PE, CAE, MIES
Executive Vice President

345 East 47th Street
New York, New York 10017
212 705 7913

March 10, 1983

Hon. Doug Walgren
Chairman
Subcommittee on Science, Research
and Technology
2319 Rayburn House Office Building
Washington, D.C. 20515

Dear Chairman Walgren:

The Illuminating Engineering Society of North America is this continent's technical society for the advancement of the art, science, and practice of illumination, and, as such, is concerned when any activity that can contribute to such advancement is discontinued. We view, with alarm, the proposed curtailment of the National Bureau of Standards' Center for Building Technology activity, as CBT Has been a stimulant and valued contributor to recent advancements in the illumination field.

With this country's need to conserve energy, it was the CBT that stimulated conservation in buildings by preparing drafts of material relating to building energy use. Those drafts have evolved into ANSI/ASHRAE/IES Standard 90-75, Energy Conservation in New Building Design. Current CBT interdisciplinary studies should provide needed input for further conservation measures.

CBT's staff involvement in IES committees has provided us with the government's point of view and has helped to guide the development of new energy-conscious design criteria and design procedures. In addition, as new energy efficient equipment has been developed and applied, CBT has been analyzing their effects on public safety and welfare.

CBT has lent its expertise to recent reviews of the state of the art and to a study of lighting research and education needs through cosponsorship of two effective roundtables.

.....continued

March 10, 1983

Page 2

Hon. Doug Walgren

There would be a definite void without the resources and stimulation provided by the Center for Building Technology.

Sincerely,

Rogers B. Finch

BRF:jk

cc: Tom Kramer (staff person) ✓

Office of the Mayor

Richard L. Berkley, Mayor

City of Kansas City, Missouri
Heart of America

29th Floor, City Hall
Kansas City, Missouri 64106

816 274-2595

March 11, 1983

The Honorable Doug Walgren
United States Representative
Chairman, Subcommittee on Science,
 Research, and Technology
2319 Rayburn House Office Building
Washington, D.C. 20515

Dear Representative Walgren,

It has come to my attention that the Administration's proposed budget for the upcoming year would eliminate the Center for Building Technology of the National Bureau of Standards. Since this was the division which conducted the investigation into the causes of the 1981 Hyatt skywalk collapse here in Kansas City, I have had first hand knowledge of the division and would like the opportunity to comment on the proposed cuts.

I would hope that there will be no more structural failures in this country like the one at the Hyatt. Unfortunately, we know this will not be the case; there will be other tragedies and failures of construction and these will have to be investigated fully so that causes of the failure can be determined and experience can be gained to avoid future calamities.

This is an area in which the federal government must participate. Structural collapses, like airplane crashes which are investigated by the FAA, carry the potential for massive loss of lives. Accordingly, our government has a responsibility to investigate structural failures.

I believe that the federal government has an obligation to the people of the country and to future generations to fund this program which is the only one of its kind in existence. Because of special interests and other factors, the private sector could not fill the same role as effectively.

In my years of working with federal employees at all levels, I have seldom been as impressed as I was when working with the staff of the NBS. Professional, unbiased, highly skilled, intelligent, and dedicated - they performed a service for this city and the country that will long be remembered and appreciated. To eliminate this program would be a serious disservice to the citizens of our nation.

Very respectfully,

Richard L. Berkley

E R N S T   F U E L   &   S U P P L Y   C O.

"READY MIXED CONCRETE"

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PRESCOTT 5-7200

March 15, 1983

Rep. Doug Walgren, Chairman
House Subcommittee on Science, Technology and Space
U.S. House of Representatives
117 Cannon House Office Building
Washington, D.C. 20515

Dear Representative Walgren:

It has come to our attention that hearings will begin on March 22, 1983, on the 1984 budget proposals for the National Bureau of Standards. We are deeply concerned about the proposed reductions in funding for the National Voluntary Laboratory Accreditation Program (NVLAP) and the Center for Building Technology (CBT).

Non-standard testing has long been a source of severe problems and expense for the concrete construction industry. Every ready-mixed concrete producer can cite example after example of projects which have been delayed due to poor testing practices. In many instances, owners and concrete suppliers have suffered unwarranted expense by having to prove the quality of the concrete in-place, placed in doubt by strength specimens molded and handled by poorly trained personnel and, in many cases, tested in laboratories which fail to meet minimum standards.

In concrete construction, strength specimens are molded during placement to measure the potential strength of the concrete as delivered to the job-site and/or to indicate when the form work can be safely removed from structures. Obviously, improper molding and testing of these specimens creates a serious potential danger to the safety of workmen during construction, and the general public when the structure is in use.

Our industry is addressing the serious issue of non-standard testing in two ways. One, we are promoting mandatory certification of technicians testing concrete. Many intra-state organizations have come together to establish certification programs for this purpose. In Michigan, we are making excellent progress toward this end, having now had about seven years of actual experience in certifying field testing personnel. We now have over three hundred technicians certified and continue to increase that number. We are now at the point where mandatory certification may be included in some project specifications. This part of our goal, personnel training, can and is being successfully addressed on the state level.

Rep. Doug Walgren, Chairman
Page 2
March 15, 1983

The second part of our problem with non-standard testing is being addressed by NVLAP and the Cement and Concrete Reference Laboratory (CCRL) of the CBT. As you know, these programs address the testing of samples submitted to a laboratory. In the areas where the NVLAP has been utilized, the general level of testing, including non-NVLAP approved labs, has improved. This type of lab accreditation can only be successfully accomplished by the NVLAP and CCRL. We simply do not have the resources to do this type of certification on a local level.

This resolution of the non-standard testing problem with the help of NVLAP and CCRL is our primary concern. However, the other activities of NBS such as fire safety research and work on industry committees of ACI, ASTM. etc. help create vital data and input for improving the quality and safety in the construction industry.

Both programs are self-funding to a significant degree, and, therefore, we feel it only makes sense that they continue to receive federal support.

One suggestion for improving the quality of testing in federally-funded projects would be to insist that the private laboratories which are used for quality assurance testing be certified by both NVLAP and CCRL.

Again, we strongly object to these proposed budget reductions of programs which generate such great benefits to the public at such relatively low expenditures.

We urge you and your subcommittee to, at the very least, restore these cuts, and consider increasing these allotments.

Yours truly,

ERNST CONCRETE & SUPPLY CO.

Thomas Adams

Thomas Adams

TA/ab

March 18, 1983

Kalazmazoo Ready-Mix Concrete Co.
342 Claymore Blvd.
Richmond Hts., Ohio 44143
March 16, 1983

To: Honorable Doug Walgren
Chairman
House Subcommittee on Science, Technology & Space
U. S. House of Representatives
117 Cannon House Office Bldg.
Washington, D.C. 20515

Dear Mr. Chairman:

Concrete Construction is one of the basic ingredients needed for a healthy and prosperous United States.

I am writing in support for restoration of funds to the 1984 NPS budget for NVLAP and the CCRL. NAVLAP and CCRL offer invaluable services to the concrete industry to insure proper testing and evaluation of the most widely used versatile and economical construction material used today.

The health and welfare of the American public depends on proper testing and evaluation of concrete. As a former concrete producer in Kalamazoo, Michigan, I appreciate the total effort of the Bureau of Standards. American businessmen appreciate some government assistance, but abhor unnecessary government regulations and control.

Please allow sufficient funds for NVLAP and CCRL to function efficiently.

Yours very truly,

George R. U. Burg

George R. U. Burg
Vice President & General Manager

GRUB/eb
CC: Senator Slade Gorton, Chairman
Senate Subcommittee on Science,
Technology & Space,
U.S. Senate
3327 Dirksen
State Office Bldg.
Washington, D.,C. 20510

Mr. Dick Gaynor, V.P. of Engrg & Res.
900 Spring St.
Silver Spring, Md. 20910

R. L. Johns

J. C. Williams

TRANSIT MIX CONCRETE COMPANY
P.O. BOX 849 • 444 EAST COSTILLA
COLORADO SPRINGS, COLORADO 80901
PHONE 303-475-0700

March 18, 1983

Rep. Doug Walgren, Chairman
House Subcommittee on Science, Technology and Space
U. S. House of Representatives
117 Cannon House Office Building
Washington, D. C. 20515

Dear Representative Walgren:

We are very concerned about the proposed funding reduction targeted for the NVLAP and CCRL programs. As a member company of the Colorado Ready Mixed Concrete Association we have put together numerous seminars and Concrete Field Technicians Certification schools for producers, contractors, the Highway Department, and most importantly, Concrete Test Lab personnel. These two National Bureau of Standards programs are extremely important to the construction industry in that if we train and certify the technicians for the field portion and the government programs insure proper test lab procedures, the consumer, commercial and industrial owners, and the various governmental owners can be assured of a safe, high quality bridge, building, highway, dam, etc.

We solicit your support of the repeal of this budget reduction and will provide any additional information you may require which we are able to supply.

Very truly yours,

Carl C. Herskind

Carl C. Herskind
Operations Manager

CCH:kb

MATERIAL SERVICE CORPORATION
300 WEST WASHINGTON STREET · CHICAGO, ILLINOIS 60606 · 312/372-3600

March 18, 1983

Representative Doug Walgren, Chairman
House Subcommittee on Science, Technology & Space
U.S. House of Representatives
117 Cannon House Office Building
Washington, D.C. 20515

Dear Mr. Chairman,

As an active member of the National Ready Mix Concrete Association, and a large producer of concrete and aggregate in the Chicago area, we are vitally interested in the improvement of the quality of testing of concrete and aggregate in our industry.

Poor testing can and has led to untold job delays, unnecessary job meetings, legal action, and has cost many many dollars while the problems are being rectified.

Most people are not aware of the sophistication and the importance of testing in the construction industry.

For example, The 1980 Annual Book of ASTM Standards, Part 14, Concrete and Mineral Aggregates, has 153 specification and tests pertaining to just concrete and mineral aggregates and related products.

Some of these tests are quite critical in the evaluation of structural integrity and safety of the structure not only while it is being built but long after it has been put in service.

I think we have to expand not curtail, certain activities in the science and technological areas.

The National Voluntary Laboratory Accreditation Program is just such a program to help the construction industry to improve test methods and reliability. Proficiency testing will aid us to recognize competent laboratories.

The Cement & Concrete Reference Laboratory (CCRL), plays a vital role with its inspection of testing laboratories, to ascertain that the people and equipment are capable of performing to the proper standards.

I realize our president is trying to reduce the federal deficit of which I am in total agreement, however, I think certain programs are vital and should be conditioned and in some cases expanded.

Sincerely yours,

Ralph Vencill

Ralph Vencill
Manager - Technical Affairs

RV/jg

NATIONAL CONCRETE MASONRY ASSOCIATION

National Concrete Masonry Association

2302 Horse Pen Road
P.O. Box 781
Herndon, Virginia 22070
Phone (703) 435-4900

March 22, 1983

Congressman Doug Walgren
Sub-Committee on Science, Research & Technology
2319 Rayburn House Office Building
Washington, D.C. 20515

Dear Congressman Walgren:

RE: Center for Building Technology of the Commerce Dept. Budget

The National Concrete Masonry Association strongly supports the inclusion in the NBS Budget of the Commerce Department of 3.17 million for building research to maintain the Center for Building Technology. We respectfully request your support of this minimum budget which is necessary to keep the Center for Building Technology in existence.

The CBT is the only comprehensive non-proprietary laboratory in the U.S. dedicated to meeting the measurement needs of the building industry. Construction is one of the largest industries in the nation, however, it is very highly fragmented. Because of this characteristic, there does not exist anywhere in the U.S. any other organization which is capable of performing unbiased research which bridges all of the trades and examines materials required to build a building.

A large percentage of the companies engaged in construction, including most manufacturers of concrete masonry units are small businesses, and are not financially able nor are they sufficiently qualified to perform the necessary testing required for the proper evaluation or performance of their products, particularly as they function in conjunction with other elements in a building. Those companies that are large enough and capable of operating their own laboratories would tend to test those characteristics that would be biased in favor of their products.

The Center for Building Technology is capable of performing tests and evaluation services that bridge all segments of our industry without bias. The Center's laboratories are well equipped and ready for use. They are able to test full size walls, earthquake loadings, environmental influences, dynamic thermal performance of walls and other components, R values of thick insulation, acoustical measurements and many other capabilities too numerous to mention.

A specific example of a test program at NBS that is of particular interest to NCMA and the masonry industry is the field study of the effect of wall mass on the heating and cooling loads of residential buildings. The purpose of the test is to measure the effects of mass in residential construction. The results will be used by HUD and DOE to determine the amount of insulation required in masonry homes. The results will also be able to validate proper computer programs now in use such as NBSLD and DOE 2.

The NCMA with its headquarters in Herndon, Virginia represents more than 600 member companies with production facilities located in every major market area in all 50 states. Ninety-five percent of our members are classified small businesses, none of which have the necessary resources to support a test facility which would be able to perform the services presently being supplied by CBT. Because of NCMA's members' size, they cannot support an extensive industry laboratory. NCMA's budget for research is less than $150,000.

Industries involved in construction, whether they be large or small, should not be charged with the responsibility of testing their products as they relate to, or work with other systems, for the reasons previously stated. Universities do not offer an acceptable alternative solution because they do not have "in house" the technical staff which is required and their staffs would have to be trained for each separate program which would add to costs and also raise the question of creditability. Their costs to train staff and support suitable equipment makes their prices for industry research beyond our means.

The Center for Building Technology exists now - it has the staff and physical plant necessary to perform a needed impartial service for the construction industry. Their past efforts have made buildings safer, more efficient, and economical.

We again respectfully request that you support the inclusion of 3.17 million dollars to keep the Center for Building Technology in existence.

Sincerely,

Paul Lenchuk

Paul Lenchuk
President

National
Gypsum
Company
Cement Division

March 22, 1983

The Honorable Doug Walgren, Chairman
House Subcommittee on Science,
Research, and Technology
U.S. House of Representatives
117 Cannon House Office Building
Washington, DC 20515

Dear Mr. Chairman:

The Cement Division of National Gypsum Company strongly supports the activities of NVLAP and CCRL. We urge that these programs be continued by inclusion in the National Bureau of Standards budget for fiscal year 1984. The need to reduce the federal budgets is understandable, but the support of NVLAP and CCRL is more than justified by the benefits to the construction industry and to public safety.

The Cement Division is concerned with many instances of improper testing of concrete that disrupt construction projects needlessly. These types of problems might have been avoided had the testing laboratories been involved in the NVLAP program. The exchanging of testing data of portland and masonry cements has resulted in a general upgrading of testing procedures. The reference sample program conducted by CCRL produces many benefits, including a method of cross-checking testing data.

The NVLAP and CCRL programs are substantially self-funding, but federal support is more than justified by the benefits derived. Please give these programs serious consideration for inclusion in the 1984 budget.

Sincerely,

Edward J. Price

Edward J. Price
Director, Governmental
and Public Affairs

dag

Executive Offices · P.O. Box 887 · Southfield, Michigan 48037 · 313-354-9050
*Manufacturers of **Allentown** and **Huron** cements*

IES

Illuminating Engineering Society of North America

Rogers B. Finch, PE, CAE, MIES
Executive Vice President

345 East 47th Street
New York, New York 10017
212 705 7913

March 22, 1983

The Honorable Doug Walgren, Chairman
Subcommittee on Science, Research and
Technology
2319 Rayburn House Office Building
Washington, D.C. 20515

Dear Chairman Walgren:

For the information of your Subcommittee, I am enclosing a statement of Stephen S. Squillace, immediate past president of this Society. It concerns his views on the question of the future status of the Center for Building Technology.

I am aware that hearings on the budget for the National Bureau of Standards are being held this week. Because this statement is consistent with the views expressed in my letter of March 10, I hope it will be given full consideration during these hearings.

Sincerely,

Rogers B. Finch

RBF:jk
encl.
cc: John Holmfeld (staff person)

SH&G

STATEMENT ON THE 1984 BUDGET PROPOSALS
for the
CENTER FOR BUILDING TECHNOLOGY
# of the
NATIONAL BUREAU OF STANDARDS

by
Stephen S. Squillace, P.E.
Immediate Past President of the Illuminating Engineering
Society of North America
Vice President and Corporate Director of Electrical
Engineering at Smith, Hinchman & Grylls Associates, Inc.

Smith, Hinchman & Grylls Associates, Inc.
455 West Fort Street Detroit, Michigan 48226 313/964-3000 810/221-9463 Telex
Architects Engineers Planners
A Member of The Smith Group Inc.

Stephen S. Squillace, PE, FIES Vice President & Corporate Director of Electrical Engineering

My name is Stephen S. Squillace and I am the immediate past president of the Illuminating Engineering Society of North America. I am also a Fellow of that Society.

I belong to the National Society of Professional Engineers and I am registered in four states: Michigan, Ohio, Indiana and North Carolina.

I presently hold the position of Vice President and Corporate Director of Electrical Engineering at Smith, Hinchman & Grylls Associates, Inc.

It has come to my attention that strong consideration is being given to the elimination of the Center for Building Technology, presently affiliated with the National Bureau of Standards. I would like to speak contra to the above idea and would submit the following arguments for the reauthorization and proper funding of the Center for Building Technology.

The Center has co-sponsored, with the Department of Defense, the gathering of Solar Radiation data which has made it possible to write computer programs which, in the hands of qualified professional engineers, allow for a much more accurate hour-by-hour calculation of heating and cooling loads and thus prevents the overdesign that, in the past, has resulted in the squandering of precious resources. This work is still continuing and it would be unconscionable to dismantle the teams which have gathered the data and assisted the private sector to attain a better and sounder engineering approach to the design of HVAC systems. Such teams should continue and should train new people to continue the work in the future. The small business sector of our country cannot afford to do such work alone and, left to its devices, it will squander resources, not willingly, but reluctantly. The above effort may result in a joint venture between the American Society of Heating, Refrigerating and Air Conditioning Engineers and the Center for Building Technology to put this data in the Handbook for Mechanical Engineers. The ASHRAE committees and the CBT personnel are presently working together in committee to bring this to fruition. A stopping of this effort at this point would be a great loss.

The above measurements led to another joint effort which involved the National Fenestration Council and the Center for Building Technology. The need for sky luminance measurements in all geographic locations of our great land led to the use of modified instrumentations garnered from the solar radiation measurements and using the same, but modified, facilities. Sky luminance measurements have been made at Bethesda, Maryland, which can be used as a prototype for continuing measurements all over our country. We can, if we continue this work, begin to design meaningful and efficient combination daylighting and artificial lighting systems for the further conservation of resources. The elimination of these efforts will result in the loss of data already gathered and the waste of taxpayers' as well as the private sector's monies which have helped fund this effort. Further, the teams which have been used to gather data will seek other employment since, again, the private sector has no real incentive and not enough capital under our laws to continue such work alone.

The Center for Building Technology has also co-sponsored, with the Illuminating Engineering Society of North America, a private sector 501C3 organization, two Roundtables in Illumination to help give direction to a national plan for lighting research and education. These two roundtables have now resulted in an industry-wide lighting research and education fund raising campaign in order to motivate the academic (as well as other educational sectors) to look at curricula for lighting educators. Further, the Lighting Research Institute, founded in 1982 as a 501C3 organization, will broker the research agenda that the roundtables have delineated as user needs. A third roundtable is now just beginning to be organized to keep the community in touch with each other so that all forces will move to cause a proper and meaningful resultant. This third roundtable will be co-sponsored by the Illuminating Engineering Society of North America, the Lighting Research Institute, the Electric Power Research Institute and the Center for Building Technology. If the CBT ceases to exist, we lose, for the entire nation's lighting community, the ability for our government to simultaneously understand with us, the lighting community, the problems we face and the solutions we propose to offer; and further, we lose the input from government, which may be very helpful to effectuate rational and meaningful solutions to problems. About a year ago, as President of IESNA, I wrote to President Reagan outlining the joint effort between government and private sector to sponsor the roundtables which have led to a private sector funding campaign.

There are other instances in other disciplines (other than lighting) where the Center has been an absolute boon to the private sector. A few of these are:

1. The recent Hyatt tragedy in Kansas City where the Center has made an in-depth study of the accident, giving the structural community great help in understanding what happened there and leading to ideas on how to minimize possible reoccurrences.
2. Other items as attached.

In conclusion, while we believe that the private sector can and should take care of as many problems as it can for its own business purposes, it is further true that some ventures must be joint with our government in order that standards, codes and regulations become meaningful and useful, instead of a waste of monies.

1/26/83

Center for Building Technology Major Accomplishments

1. Research on occupancy, wind and earthquake loads, prediction of structural resistance, and structural reliability is incorporated in the 1982 ANSI Standard "Minimum Design Loads for Buildings and Other Structures" and available for use in building codes. New provisions will increase structural reliability and reduce design costs.

2. Reported on the physical causes of major structural failures, such as the 1981 walkway collapse in Kansas City that killed 114, the 1982 overpass failure in East Chicago that killed 13 construction workers, and the 1978 cooling tower collapse at Willow Island that killed 51 construction workers, to assure that causes are publicly known and can be avoided in the future.

3. Provided technical support to the private sector Building Seismic Safety Council in the formulation of nationally applicable, comprehensive seismic design provisions suitable for use in voluntary standards and building codes, and in the development and conduct of a trial design program to provide the basis for recommendations of the provisions for adoption.

4. In cooperation with the National Conference of States on Building Codes and Standards and the State of Massachusetts, developed a more cost effective approach to regulation of building rehabilitation that has been adopted by Massachusetts and incorporated in rehabilitation guidelines of the Department of Housing and Urban Development, and formulated methods for condition assessment of existing buildings that are being processed as a national standard by the American Society of Civil Engineers.

5. At the request of the National Conference of States on Building Codes and Standards developed a technical approach for a nationally applicable energy conservation design standards for buildings that has been developed as a national standard by the American Society for Heating, Refrigerating and Air-Conditioning Engineers and provides the basis for the energy building code requirements of 44 states.

6. In response to legislation: formulated performance criteria for solar heating, cooling and hot water systems for residential and commercial buildings to provide the building community with levels of performance and means to evaluate solar systems; formulated test methods, now incorporated in national standards, for assessing the durability of materials in solar systems and the thermal efficiency of solar components to provide effective communications between suppliers and users in the marketplace.

7. Developed a one-meter line source guarded hot place to permit direct measurement of thermal insulation performance at thicknesses up to 12 inches (the earlier standard was one inch) and provided calibrated transfer specimens to manufacturers to allow them to meet labeling requirements without excessive uses of material.

8. In cooperation with the National Roofing Contractors Association developed performance criteria and test methods for reliable roofing systems and disseminated them in biannual National Roofing Conferences.

9. Developed performance criteria and test methods for protection of reinforcing bars in concrete from salt-induced corrosion that have led to adoption of national standards and use of coated reinforcing bars in most bridge decks in areas subjected to freezing weather.

10. At the Request of the American Society for Testing and Materials and the American Association of State Highway and Transportation Officials, inspections are provided of test equipment, procedures and results for 580 public and private laboratories nationwide to strengthen quality assurance for building and transportation facilities.

IMPACT ON BUILDING COMMUNITY

Building Research:

- The entire NBS program in Building Research will be eliminated. The program includes substantial efforts in structural engineering, building materials, building equipments, and systems.
- This would leave the U.S. as the only developed country in the world without a national building research laboratory.
- This is the only integrated program in the Nation able to deal with complex technical issues affecting the entire building industry.
- This program makes major contributions to reducing the burden of unnecessary or ineffective building regulations while maintaining essential levels of safety.
- This is the only integrated, non proprietary program in the nation aimed at removing technological market barriers of the construction industry, e.g., development of a referee method for measuring the R value of thick insulation.
- This is the only neutral laboratory capable of investigating major building and construction disasters, e.g., the walkway collapse in the Kansas City Hyatt Regency in 1981 and the East Chicago Indiana highway ramp collapse in 1982.
- This program is the only authoritative Federal laboratory resource available to Federal agencies with building concerns, e.g., OSHA, GSA, FEMA and the White House.
- The program is the major non proprietary source of technical information for the development of voluntary standards for buildings by organizations such as the ASTM, American Concrete Institute, American Society of Heating, Refrigerating and Air C onditioning Engineers, model building code organizations, etc.
- It has a key assigned role in the National Earthquake Hazards Reduction Act for the technical support of the development of seismic design and construction provisions.
- This program provides quality assurance for 580 public and private laboratories nationwide that are relied upon by owners, designers, builders, State and local governments for buildings and transportation facilities.
- Private sector R&D and innovation are stimulated by this program's authoritative, non-prescriptive performance measures for building materials, systems and components.
- This program represents the U.S. building community in international building standards activities to assure the international competitiveness of U.S. construction products and services.

CONROCK CO.

3200 SAN FERNANDO ROAD / P.O. BOX 2950 / LOS ANGELES, CALIFORNIA 90051 / (213) 258-2777

April 7, 1983

Representative Doug Walgren, Chairman
House Subcommittee on Science, Technology & Space
117 Cannon House Office Building
Washington, D. C. 20515

Dear Representative Walgren:

This is to express support for the National Voluntary Laboratory Accreditation Program (NVLAP) and Cement and Concrete Reference Laboratory (CCRL) programs.

CONROCK CO. is a large publicly held company supplying construction aggregates and ready mixed concrete to a seven county Southern California market. Our participation in these programs is fostered by the belief that consistent, reproducible testing of our products is needed to optimize the quality of concrete construction in our market place. NVLAP and CCRL programs supply needed bench marks that allow us to create a testing environment that meets these needs.

Yours truly,

R. West

Robert M. West

cc: R. D. Gaynor
    H. L. Harger
    D. Reining

APPENDIX IV

Fire and Buildings Research Programs

STATEMENTS AND LETTERS

National Forest
Products Association

Ralph D. Hodges, Jr.
Executive Vice President

Forest Industries Building • 1619 Massachusetts Avenue, N.W.
Washington, D.C. 20036 • 202/797-5810

February 22, 1983

The Honorable Douglas Walgren
Chairman, Subcommittee on Science,
Research and Technology of the
Committee on Science and
Technology
Cannon House Office Building 117
Washington, D.C. 20515

Dear Mr. Walgren:

Reference is made to forthcoming hearings on the role and future funding of National Bureau of Standards (NBS) programs in the fields of building technology and fire research.

The National Forest Products Association is a federation of lumber and wood products associations and producing companies throughout the United States. Among the services performed for this membership, we have had a history of extensive involvement in building codes, construction standards and regulations relating to structural design and fire performance of buildings.

For the past 10 years we have financially sponsored a fire-research associate at the NBS Center for Fire Research. We are also familiar with fire testing performed by the Center and its activities in development of fire performance standards.

We have monitored energy performance testing of the Center for Building Technology (CBT) and have a close familiarity with the "Operation Breakthrough" housing standards effort of the CBT with HUD a number of years ago.

As a result of this and other experience, we believe the NBS Center for Building Technology and the Center for Fire Research serve a useful purpose in development of basic data on wind, snow, seismic forces, and fire technology involved in design of buildings. We have been concerned, however, with a perceived tendency of NBS personnel to attempt to establish performance limits on materials and constructions and to utilize the prestige of NBS in advocating acceptance of proposed standards and in seeking enactment of building code requirements before consensus is achieved on pending standards.

Mr. Walgren
February 22, 1983
Page two

In short, we support limited NBS building technology and fire research activities primarily in the basic data development fields. We ask that a mechanism for industry guidance to such developmental effort be established. And, we urge that the National Institute of Building Sciences, as authorized under Public Law 93-383, be assigned responsibility for analyzing the role of NBS involvement in building and fire technology and recommending specific areas of research need.

Sincerely,

Ralph D Hodges Jr.

Ralph D. Hodges, Jr.

AMERICAN SOCIETY OF CIVIL ENGINEERS

345 EAST 47th STREET • NEW YORK, N. Y. 10017-2398 • (212) 705-7496

From the President • **JOHN H. WIEDEMAN**
Wiedeman and Singleton, Inc.
1789 Peachtree Road, N.E.
Atlanta, GA 30309
(404) 876-5862

March 3, 1983

Congressman Doug Walgren
2441 Rayburn Office Building
Washington, D. C. 20515

Dear Congressman Walgren:

The Science and Technology Committee News Release dated February 25, 1983 concerns hearings that you will conduct on the Bureau of Standards programs in Building and Fire Research. ASCE supports continuation of these programs. Several of our members are preparing detailed statements on the issues.

Sincerely,

John H Wiedeman

John H. Wiedeman

JHW:ms

CIVIL ENGINEERING: *A PEOPLE-SERVING PROFESSION*

BUILDING OFFICIALS AND CODE
ADMINISTRATORS INTERNATIONAL, Inc.

SOUTHERN BUILDING CODE
CONGRESS INTERNATIONAL, Inc.

INTERNATIONAL CONFERENCE OF
BUILDING OFFICIALS

Council of American Building Officials

1201 ONE SKYLINE PLACE • 5205 LEESBURG PIKE
FALLS CHURCH, VA 22041 • (703) 931-4533

RICHARD P. KUCHNICKI
EXECUTIVE DIRECTOR

March 11, 1983

The Honorable Doug Walgren
Chairman
Subcommittee on Science, Research
  and Technology
U.S. House of Representatives
2319 Rayburn House Office Bldg.
Washington, D.C. 20515

Dear Congressman Walgren:

The Council of American Building Officials (CABO) wishes to express its views on the proposed 1984 budget cuts within the U.S. Department of Commerce involving the Center for Building Technology and the Center for Fire Research within the National Bureau of Standards (NBS).

CABO is a consortium of the three major model code organizations--Building Officials and Code Administrators International, International Conference of Building Officials and the Southern Building Code Congress International--whose members are responsible for creating and enforcing building regulations in more than 10,000 jurisdictions throughout the United States. CABO serves to enhance, at the national level, the continuing efforts of its members in the interest of public health, safety and general welfare. Each CABO member publishes model codes for building, plumbing, mechanical, fire prevention and other related documents that are available at low cost for adoption by any local or state unit of government anywhere in the world.

The U.S. Department of Commerce has proposed the phasing-out of the National Bureau of Standards Center for Building Technology and Center for Fire Research. CABO is concerned with this action.

The competitive nature of the building industry forecloses certain areas of basic research. Simply put, the kinds of research which could be performed by NBS are those which profit oriented companies and their associations are not likely to perform. In past years, NBS has done research studies which were helpful in the formulation of building code requirements. This type of research can reduce the loss of life and property due to fire or assist to provide safe housing at an affordable price. On this basis, CABO suggests that favorable consideration should be given to continued funding of the Centers for Building Technology and Fire Research. But, only if program selection and performance are markedly improved.

Council of
American
Building
Officials

PAGE - 2 -
The Honorable Doug Walgren
March 11, 1983

In recent years, NBS research has drifted to areas of research which are impractical or marginally related to regulatory interests. Continued funding for CBT and CFR should only be done with assurance of much greater involvement of the private sector in the determination of these missions and a review of the quality of work in carrying them out. This could be done through the watchful supervision of some advisory group which will provide needed oversight of projects and also have a significant role in project selection. CABO believes that the National Institute of Building Sciences (NIBS) is the appropriate organization to enlist in this rule. We believe that this was the intent of Congress when it passed Public Law 93-383 in 1974.

In summary, CABO urges the Congress to provide necessary operational and research funds for the Center for Building Technology and the Center for Fire Research of the National Bureau of Standards under a NIBS oversight committee process which will provide direction and evaluation of program selection and comments.

Sincerely,

Richard P. Kuchnicki
Richard P. Kuchnicki
Executive Director

RPK/dfr

American Iron and Steel Institute
1000 16th Street, N.W., Washington, D.C 20036

William H. Hoffman, Jr.
Vice President
Government Relations
(202) 452-7230

March 21, 1983

The Honorable Doug Walgren
Chairman
Subcommittee on Science, Research, and Technology
Committee on Science and Technology
U. S. House of Representatives
Washington, D. C. 20515

Dear Mr. Chairman:

The budget for the National Bureau of Standards submitted by the Administration calls for the elimination of the Center for Fire Research and the Center for Building Technology.

I am writing on behalf of the American Iron and Steel Institute to urge that you support the restoration of these funds to the NBS as you begin hearings on its FY 1984 budget.

(Senator Gorton has introduced a bill, S. 821, which would restore these funds, among others, to NBS, and we have written him in support of his effort. He would restore $5.886 million to the Center for Fire Research and not less than $4.009 million for "Building Research.")

The research resources required to effectively deal with the reported annual fire waste in the United States, which involves 8,000 deaths and $20 billion in direct and indirect property loss, is beyond the financial and technical resources of any one industry or industry group. The fire research effort requires the talent of many different scientific and engineering disciplines doing the pieces of research which are then fitted into the total fire safety puzzle. The Center for Fire Research has the staff and facilities to efficiently and effectively concentrate on the fire safety problem as it affects the public. No industry or existing private testing facilities can approach the research capabilities of the Center for Fire Research.

Currently industry is participating directly in research at CFR through the Research Associate Program. AISI is only one of many industry groups that have financially contributed to fire research studies at CFR. Several of these studies are explained in attachments to this letter.

The unique aspects of the fire problem necessitates the development of new test methods and time-consuming experimental evaluation required of test methods before recognition and acceptance by the technical community. These test methods are adopted by consensus action of the various voluntary code and standards writing organizations. In turn, the tests are adopted as part of the performance criteria in building regulations which are designed to protect the general public from injury and personal property loss resulting from fire. Because of the end use of fire test methods in building codes, the Center for Fire Research is especially suited to develop such tests and conduct the basic research. It is essential that the current broad base funding for this CFR activity be continued.

The Center for Building Technology has undertaken a wide range of activities which have resulted in improvements in construction technology and the knowledge of structural and building performance resulting in design techniques to make buildings safer from the effects of natural hazards such as earthquake and wind storms. The CBT program has made major contributions in relieving the burden of unnecessary regulations on construction while maintaining essential levels of safety. Some of the significant studies and activities of the CBT are explained in attachments to this letter.

The Center for Building Technology and Center for Fire Research have proven records of accomplishments and offer unique facilities and perspectives that cannot be replicated by the private sector.

We, therefore, urge you and your colleagues to restore the funds as specified in S. 821 to enable them to continue their invaluable services to the Nation.

Sincerely,

Bill Hoffman

Enclosure

A. CFR FIRE RESEARCH ON TOXICITY OF BURNING COMBUSTIBLES

Fire experience in the United States indicates that approximately 75 percent of fire deaths in building fires are caused by the toxic effects of the products of combustion from burning building materials and furnishings. In a recent report published by the National Fire Protection Association from a study by the Committee on the Toxicity of the Products of Combustion, seven primary areas were noted as requiring additional study. Three of these are related to research currently under way at the Center for Fire Research and are as follows:

1) Standardized and improved methods of autopsy examinations and medical evaluations should be an integral of fire investigations; Improved quality control of biochemical measurements made on fire casualities,
2) Long term medical assessment of fire fighters and survivors of fires, especially for residual respiratory and cardiovascular changes, and
3) Studies of the composition of combustion and pyrolysis products in the fire environment must be integrated with toxicological and medical evidence of the physiological effects in animals and fire casualties

Recognition was given to the CFR biological toxicity test, but it was indicated that certain conditions should be studied to make the NBS test protocol more effective. The recommendations for further research are as follows:

1) A uniform distribution of heat and smoke throughout the animal exposure chamber.
2) Samples tested under conditions representative of their end use configuration.
3) A method for determining a meaningful exposure time, especially for testing materials that decompose at different rates.
4) Chemical measurements of the principle components of the combustion products.
5) A method of monitoring and correcting for concentration changes due to absorption of combustion product mixture to which the animals are exposed.
6) Sample weight loss versus time measurement (thermogravimetric monitoring).
7) Measurement of toxicity in exposed animals short of death such as time to incapacitation and persistent effects in surviving animals.

The scope of any project involving toxicity of combustion products requires the interface of many different specialized disciplines and unique test facilities which can be productive in developing necessary test procedures. AISI has proposed a cooperative research program at the Center for Fire Research making use of the CFR laboratory fire research facilities and technical staff to study the following:

1) Develop a toxic hazard assessment as part of any fire hazard assessment for life safety in fires.
2) Combine the existing room fire growth models developed by AISI and CFR.
3) Combine the research on standardizing a test method for determining the toxicity of combustion products with the AISI sponsored project for on the scene determination of death of fire victims which is to be studied in three cities in the United States with cooperation from the local fire department and the medical examiners office.

The proposed AISI budget for this work which is to compliment the work done at the Center for Fire Research is presently estimated at $185,000.

The proposed elimination of the CFR budget will virtually stop all work by industry on this subject.

B. CFR FIRE RESEARCH AND STRUCTURAL FIRE ENDURANCE PROGRAM

AISI has contributed significant research dollars at the Center for Fire Research in a joint research program developing reliable methods for evaluating fire endurance of structural building systems. The work done to date by AISI has been evaluated through the use of a complicated test program which can only be done at the Center for Fire Research.

Through the efforts and financial contributions by AISI, a large scale, two-story test building was erected and CFR instrumented the structure so as to measure the reaction of the test structure when exposed to fire. The research program completed at the Center for Fire Research was fundamental to the successful completion of a long term effort by AISI, the Institute for the Ironworking Industry and other related industries, aimed at improving life and property safety from fire. Eliminating the Center for Fire Research will effectively destroy the capability of the efforts of the private sector to find solutions to the building fire problem.

C. CFR FIRE RESEARCH ON HVAC SYSTEMS

AISI fire research conducted at CFR has provided important technical data for modifying building codes and fire safety standards on heating, ventilating and air conditioning systems including ductwork.

Following a serious fire in New York City, fire research sponsored by AISI was conducted at CFR to evaluate the influence of the HVAC system in that building fire in spreading fire to several additional floors. The NBS research found that specific conditions must be met when ductwork penetrates fire rated floors if fire spread is to be prevented. The results of this fire research were made an integral part of fire protection standards for the safe installation of air conditioning systems.

The spread of smoke in building fires was most obvious in the MGM Hotel fire in Las Vegas, Nevada. One of the factors in the spread of smoke and hot gases from the casino fire at ground level was the air handling system. Most of the fire deaths in the MGM Hotel fire were twenty floors or more above the uncontrolled fire in the casino. Studies in smoke control during building fires include the use of the existing HVAC system, because of the elevated temperature conditions, has been questioned by many authorities. Proposed research at CFR by AISI will study the performance of currently specified HVAC ductwork under fire conditions to determine the safety and effectiveness of duct system designs presently proposed by regulations for smoke control systems.

Test equipment, instrumentation, technicians and recording equipment available at the Center for Fire Research will be lost to industry seeking to study this problem if the CFR is eliminated from the Department of Commerce budget.

D. CBT INVESTIGATION OF MAJOR BUILDING AND CONSTRUCTION DISASTERS

The most dramatic success that CBT has had recently is the definitive study on the collapse of two suspended walkways at the Hyatt Regency Hotel in Kansas City, Missouri. CBT had the technical staff to make such a study. They had the unquestioned support of the local community and they had access to the site that private organizations would not have had except with tight restrictions imposed by various financially interested parties. Never before had the construction industry learned the facts of a disaster so soon after the tragedy. There has been, for many years, routine thorough investigations of commercial airline accidents.

E. CBT EARTHQUAKE HAZARDS MITIGATION

One of the major hazards facing a great many Americans is an earthquake. Although there has been dramatic improvements (in some places) in building design and construction since the 1933 Long Beach, California, earthquake, which initiated real concern for seismic design, much is yet unknown. And what is known is not routinely applied in locations where seismic resistant construction will be seismicly tested one day. CBT is now involved in a project which they title "Technical Assessment of Earthquake-Resistant Design Provision." This effort has real value for the federal government which is the owner of a large number of buildings in active earthquake zones. It is also extremely practical for the whole construction industry. The latest improvements in seismic design provisions, drafted as a result of recent failures, have not yet been practically tested. The analytical research that is being done by CBT in conjunction with the Building Seismic Safety Council, a private organization with limited funds, will eventually save many lives.

SMACNA

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March 28, 1983

Honorable Doug Walgren
Chairman, Subcommittee on Science,
Research and Technology
2319 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Chairman:

During their recent visit with you, SMACNA contractors from Western Pennsylvania described their concerns about the proposed termination of the Centers for Building Technology and Fire Research in the National Bureau of Standards. Kenneth Enscoe, SMACNA Chapter Executive in Pittsburgh, conveyed to us your request for additional information on how terminating these Centers would affect SMACNA contractors and the public interest.

Both Centers work in areas of vital concern to the entire construction industry. For example, it is generally conceded that most fire fatalities occur because of smoke and other combustion products. Only now are we beginning to learn enough about the movement of smoke and other toxic combustion products in burning structures that we can design into air conditioning systems the capability of smoke control. If the Center for Fire Research is terminated, further advances in smoke control will be halting and erratic for there will be no single entity to lead and to coordinate research, or to conduct expert, unbiased investigations into the causes and effects of fires.

Over the years, the Center for Building Technology has conducted many programs of vital interest and concern to the air conditioning industry. When the Congress enacted a law requiring manufacturers to disclose to consumers the seasonal operating costs of furnaces, air conditioners, heat pumps and similar products, the CBT developed totally new test procedures, compatible with accepted standard rating tests but expanded to measure the efficiency--and hence economy-- of the equipment during a season of operation. The result is information which the consumer can use to compare operating costs of competitive products.

Both Centers work with the private sector in doing those things which it cannot do for itself. When developing the equipment efficiency test procedures, the Center for Building Technology kept industry advised of what was being done and sought industry assistance to make sure that, in addition to being technically correct, the tests could be conducted in industry laboratories. Both Centers work with industry and make possible the more effective utilization of both private and government resources.

continued. . .

It has been suggested that the programs of the Centers for Building Technology and Fire Research could be conducted economically and equally well by the private sector. Simply put, any such suggestion is wholly without merit, and there are many reasons for that. These include, of course, the expertise found in these Centers, and the credibility of their work as being unbiased. Any industry claim to lack of bias, even though true, would lack credibility. Engaging in certain types of standardization activities is risky business for any industry. Attempts by competitors to reach a consensus are likely to be viewed with suspicion by those agencies of government which enforce the antitrust laws. In many situations, agreements of great value to the public can be made legally only if they are achieved with the assistance of an organization such as the National Bureau of Standards.

Terminating the Centers for Building Technology and Fire Research would be a great disservice to the public. They are of great economic benefit, as well as being vitally important to the health and safety of people in structures of all kinds. They should be continued and their programs should be adequately funded.

We appreciate the opportunity to share our views with you. If we can be of further assistance or if you need additional information, please let us hear from you.

Sincerely,

Donald D. Clark
Executive Vice President

DDC:clg

cc: Kenneth Enscoe

[illegible]

Brick Institute of America 1750 Old Meadow Road, McLean, Virginia 22102 Phone: 703-893-4010

March 28, 1983

The Honorable Doug Walgren
Chairman
House Science and Technology Subcommittee on
  Science Research and Technology
2319 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Walgren:

Pursuant to discussions with your staff, I am submitting for the record the enclosed comments of Mr. Alan Yorkdale. Mr. Yorkdale is Vice-President for Engineering and Research here at the Brick Institute. I hope these comments prove useful in preparation of the case to sustain continued CBT and CFR funding.

I would also like to take this opportunity to congratulate you and your staff on the outstanding effort you have thus far put forth in the matter of maintaining the existence of both these valuable NBS programs. Whether in Congress' wisdom the programs are to continue into the next fiscal year or be terminated at the end of the current fiscal year, your very thorough and professional investigation of the matter has at the least assured the occurence of a fair and complete debate. The work of your committee has been of significant help to the building sector and we are indebted to you.

Finally, it should be noted that Mr. Yorkdale's comments not only represent BIA, but also a significant number of organizations which comprise the masonry industry. If I, or other members of the masonry industry may be of further service, do not hesitate to call upon us.

Thank you for your attention to this matter.

Sincerely,

Joel B. Stronberg lmt

Joel B. Stronberg
Director, Government Relations

JBS:lmt
Enclosure

Brick Institute of America 1750 Old Meadow Road, McLean, Virginia 22102 Phone: 703-893-4010

A Statement by

ALAN H. YORKDALE, P. E.

on behalf of

The Brick Institute of America

and

The Masonry Industry Committee

on

The Center for Building Technology

and

The Center for Fire Research

National Bureau of Standards

before

The Subcommittee on Science, Research and Technology

Committee on Science and Technology

U. S. House of Representatives

Washington, D.C.

March 23, 1983

Mr. Chairman; Members of the Committee:

My name is Alan Yorkdale, I am a registered Professional Engineer and Vice President for Engineering and Research at the Brick Institute of America. The Institute is a not-for-profit trade association whose members manufacture 85 percent of the brick produced annually in the United States.

In addition to my capacity as Vice President of BIA, I am today in the position of representing members of the Masonry Industry Committee. The Committee is an organization of the various groups which comprise the masonry industry. They include: the Mason Contractors Association of America (MCAA); the International Masonry Institute (IMI); the International Union of Bricklayers and Allied Craftsmen (BAC); the National Lime Association (NLA); the National Concrete Masonry Association (NCMA); the Laborers International Union (LIU); and of course, the Brick Institute of America (BIA).

Before I begin to describe the masonry industry's technical argument for continuation of the National Bureau of Standards Center for Building Technology (CBT), and the Center for Fire Research CFR), I should like to note that the Brick Institute of America is not alone in its support of these two very important programs. Although I cannot speak directly for other building sector organizations, the broad-based industry support enjoyed by both CBT and CFR is an indicator of the importance of the work performed by both these centers. As the building sector is often characterized as a highly competitive and diverse amalgam of small business interests, the unanimity of support expressed by the industry for continuation of these centers' research is especially telling. Among the many groups and organizations who will be joining the Brick Institute of America in its attempt to preserve the NBS programs are: The American Institute of Architects, the Portland Cement Association, the United States Chamber of Commerce, the National Association of Home Builders, the National Association of Home Builders Research Foundation, the National Fire Protection Association, the National Society of Professional Engineers, the American Consulting Engineers Council and the National Forest Products Association.

The argument for maintenance of the NBS programs is not complicated. The Brick Institute and its masonry colleagues believe that:

- CBT and CFR have had a strong and positive influence on the building sector as a whole;

- both Centers are uniquely qualified in terms of personnel and equipment to perform the research required by industry in each of their respective fields;

- research performed at CBT is particularly outstanding for its depth, technical accuracy and thoroughness;

- the findings of CBT research are essential for development of standards which pertain to the building sector, and

- the generic research conducted at these Centers could not otherwise be performed by the private sector. In part, this is the result of the composition of the industry itself. For the most part, the building sector is a loose confederation of small busines interests without a central decision or research capcity. As businesses subjected to the traditional feasts and famines construction cycle, there is precious little capital to be invested on a sufficiently regular basis as to be able to perform the extended research of either of the NBS Centers. It must also be noted, however, that even if the construction industry was as large and monolithic as steel or automobiles, a question of neutrality would remain. Most industrial research is performed under proprietary conditions. As the basis for standards and guidelines, such research must be considered at least a little suspect. As an agency of the federal government whose mission is to serve the consumer rather than the stockholder, the Centers cannot be considered biased in their research approach. This lack of corporate interest cannot be considered lightly for purposes of regulatory efficacy.

In support of these points, I would like to use the Center for Building Technology as an example. Over the many years which the Center has been part of NBS, its work has been considered outstanding by members of the private sector. The results of its work have not only provided invaluable assistance to the standards-setting community, but also has improved the practitioners' understanding of the safety and performance requirements of buildings and building materials and systems. Among CBT's considerable accomplishments may be listed the following:

1. The basic research work in brick and concrete that was incorporated into the various standards used to determine the durability of concrete and brick products.

2. Their outstanding performance in the fields of energy conservation and passive solar energy technology, through development of measurement techniques, standardized test procedures, computer modeling of energy systems and experimental work in the field of thermal mass.

3. Their service to both the nation and the building community in the field of earthquake research and in their support of the Building Seismic Safety Council;

and

4. Their contribution of personnel and services to the numerous technical committees of the professional organizations which serve the building sector in the development and implementation of standards, test peocedures and measurement techniques. This same unselfish dedication of resources has also occurred in the international area through CBT cooperation on the technical committees of such organizations as

International Council for Building Research Studies and Documentation (CIB) and International Union of Testing and Research Laboratories for Materials and Structures (RILEM).

For the purpose of brevity, I will not elaborate upon the equally valuable contributions to building safety of the Center for Fire Research. However, I have appended a list of these accomplishments to my testimony and shall be happy to provide the Committee with any specific documentation it believes would be helpful.

As a part of the building sector, the masonry industry is acutely aware of the effects of federal expenditures on the private credit market. Because of the relationship between federal deficits and mortgage interest rates, the request for continued funding of CBT and CFR is not made lightly. Industry like government must help to find ways to reduce the cost of maintaining the federal structure. Although an across-the-board cut in all federal services would reduce the cost of government, it would do so at the risk of national health. Clearly, distinctions between the numerous federal programs must be made. Reduction of federal budgets must not be seen as an end, but as a means. Economies which do not recognize the mutual needs of decreased deficits and increased industrial activity are false. Termination of CBT and CFR is a decision which gave no attention to either the integral role which these programs play in the continued development of safe and efficient buildings, or to the industry's financial and proprietary inability to continue this work. In its request of Congress to maintain these programs, the construction industry is not asking for funds which would supplant what otherwise would or should be the responsibility of the private sector. Abdication of the federal government from this program will cause major gaps to occur in our knowledge of building technology and fire safety; gaps which will needlessly jeopardize people and property.

The Brick Institute of America and the other constituent organizations of the Masonry Industry Committee therefore suggest that the Center for Building Technology and the Center for Fire Research maintain these programs within the budget of the National Bureau of Standards. Because of the Centers' unique talents and equipment, we further believe that the House of Representatives should, at a minimum, support their colleagues in the Senate and fund these programs at levels equal to FY 1983. It is our recommendation, however, that the full Congress consider the value of increasing the annual budgets of these programs in an effort to reduce their dependency on funding from other federal agencies, i.e., the Department of Energy, and thereby increase their stability to perform the research which so greatly contributes to the technological progress of the building sector.

Mr. Chairman; members of the Committee, this concludes my remarks. At this time, I will be happy to respond to any questions you might have.

Thank you.

jcr

~~CFS~~
JH

Robert Broshar, FAIA
President

THE
AMERICAN
INSTITUTE
OF
ARCHITECTS

1735 New York Avenue, N.W.
Washington, D.C. 20006
Telephone: (202) 626-7300
Cable Address: AMINARCH
Telex: 710822 1112

March 30, 1983

The Honorable Don Fuqua
U.S. House of Representatives
Washington, D.C. 20515

Dear Congressman Fuqua:

As President of the American Institute of Architects, I want to submit the AIA's statement on the FY 1984 budget for the National Bureau of Standards' Center for Building Technology and Center for Fire Research.

In 1981 our government spent $22 million on very valuable building research at NBS. This amount was less per capita than any other developed nation and was less than amounts spent for most other U.S. industrially related research. For FY 84 the administration is recommending that all of this federally supported research be terminated. This action, if approved could make the United States the only developed nation in the world without a national research program for building technology and fire prevention. The AIA strongly opposes the Reagan Administration's proposal for zero funding for the CBT and CFR. We join others in the business community to call for Congress to fund these programs in FY 84 at no less than that approved in FY 83. Congressional hearings have demonstrated the importance of an expanded role for NBS in the exact areas the President has proposed eliminating.

With 80% of our lives spent indoors and 70% of our wealth invested in the built environment, we can not afford to reduce our commitment to improving safety in the built environment. NBS is the only one capably of performing the non proprietary technical research necessary to improve this nations life safety record, which is presently one of the worst in the world. We believe a small investment in research today will result in major savings from the prevention of future loss of life and property.

I encourage your comments and questions on our enclosed statement. Contact my office if the AIA can be of assistance to you in this or other issue areas.

Sincerely,

Robert Broshar

Robert Broshar, FAIA
President

Enclosure

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COMMITTEE ON SCIENCE
AND TECHNOLOGY

THE
AMERICAN
INSTITUTE
OF
ARCHITECTS

1735 New York Avenue, N.W.
Washington, D.C. 20006
Telephone: (202) 626-7300
Cable Address: AMINARCH
Telex: 710822 1112

THE FY 1984 BUDGET FOR THE NATIONAL BUREAU OF STANDARDS' CENTER FOR BUILDING TECHNOLOGY and CENTER FOR FIRE RESEARCH

A Statement by

THE AMERICAN INSTITUTE OF ARCHITECTS

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION
SCIENCE, TECHNOLOGY AND SPACE SUBCOMMITTEE
U.S. SENATE

The American Institute of Architects opposes the proposed elimination of funding for the Center for Building Technology and the Center for Fire Research. In our opinion, the design community and the public have benefited from the research programs carried out at the National Bureau of Standards (NBS). They have made important contributions in the areas of seismic safety, energy conservation and fire safety research.

The AIA cannot accept the administration's assertion that the private sector or local and state governments can provide the non-proprietary technical research needed in these areas. No one element in the building sector would find it to its economic advantage to carry out the activities that NBS has been responsible for. Additionally, NBS is in a position to provide impartial information, a function that would be lost if NBS's programs were to be eliminated.

The structure of the building industry prevents it from picking up the type of research that NBS carries out. The building industry, which in 1981 accounted for $234 billion or 8 percent of the gross national product, is a highly fragmented industry. Of the 1.2 million firms which employ 4.3 million workers, approximately 60 percent are small businesses. For example, 80 percent of the architecture firms in this nation have fewer than 10 employees. Engineering firms are only slightly larger. Because of this fragmentation, the research capacity of the design community is very limited. The research carried out by architectural and engineering firms is of an applied nature and is limited to the information needed for specific design and construction projects. And the research components of the building indus-try's trade and professional associations are unable to pick up the type of research that has been carried out by NBS.

In an industry such as ours, which is mainly made up of small businesses, we cannot assume that market forces, such as litigation costs from building failures, will spur private sector research. For example, architectural and engineering firms are already suffering from severe liability problems, due to incremental changes in tort law. In 1981, the claim rate for A/E firms was 45 per 100 insured firms. The average cost of these claims was $64,000. Yet, because of the fragmented nature of these experiences, this substantial increase in the cost of doing business has not brought about an increase in the amount of private sector research on structural failures. While groups like the University of Maryland's Architecture and Engineering Performance Information Center can analyze and disseminate information on structural failures, they cannot directly perform the research. Nor can any single architectural firm or consortium of architectural and engineering firms perform this type of research.

In August of 1982, the AIA testified before Congress on structural failures in public facilities, where we outlined the need for more data for the systematic analysis of the nation's building failures. At that time, the Institute applauded the Center for Building Technology's independent investigation of structural failures, such as the Kansas City Hyatt collapse. The NBS investigation provided insights into the causes of that collapse that would have otherwise gone undocumented. These investigations provide valuable information which will help prevent past mistakes from being repeated. However, we must stress that investigations on building failures are costly. For example, NBS's investigation of the Hyatt Hotel collapse cost about a half a million dollars. In most cases, the cost of these investigations on complex structures ranges between $100,000 and $500,000. Each year NBS carries out one or two in-depth investigations as well as several minor ones. We think this investigatory capacity should be expanded.

Recent structural failures and fire disasters have brought forth a public outcry for safer buildings. Research to further this goal should be carried forward with enthusiasm worthy of the public trust. Research on these subjects protects the health and welfare of the nation's citizens, a well-established federal responsibility.
By eliminating funding for these programs, the Administration seems to be saying that this long-held federal responsibility should be left to private sector organizations.

In conclusion, The American Institute of Architects has always supported programs which seek to protect the health, safety and welfare of the public. In recent years, for example, the Institute convened a Long-Span Building Panel and a Life Safety Task Force to study issues of safety in public buildings, but these limited-scope studies cannot replace the non-proprietary technical research being performed by NBS. The AIA can disseminate information generated by federal efforts to the architectural profession, as we have done in the energy area, but we cannot undertake the basic research in these areas.

Continued funding for the Center for Building Technology and the Center for Fire Research is essential to the continuation of these important areas of investigation. We believe that these programs should be funded at least in the amounts appropriated for FY 1983. NBS plays a unique role in supporting much-needed research for a highly fragmented industry. We believe the small investment in research today will result in major savings in the prevention of future loss of life and property.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.

ASHRAE / 1791 Tullie Circle, N.E. / Atlanta, GA 30329
Telephone / 404-636-8400

Clinton W. Phillips, P.E.
President

Reply to: National Bureau of Standards
Room B320, Bldg 226
Washington, DC 20234
Tel/301-921-2537

March 30, 1983

Honorable Doug Walgren
Chairman of the Science, Research
and Technology Subcommittee
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) strongly supports the work of the National Bureau of Standards especially that which applies to the buildings industry. ASHRAE is a technical society of over 45,000 individual members, among them - consulting engineers, mechanical contractors, architects and employees of manufacturers, educational institutions, research organizations or government.

As President of ASHRAE, I appreciate this opportunity to express our recommendation for continuation of the vital roles of the Center for Building Technology and the Center for Fire Research at the National Bureau of Standards.

The question which is foremost in the minds of those concerned about the possible elimination of the Center for Building Technology and the Center for Fire Research is: "Can the private sector replace these programs?" ASHRAE believes that the termination of these activities at the National Bureau of Standards will leave a real and definite void in the Nation's research and development capability which will not be replaced in the foreseeable future.

The private sector already contributes by continuing the developmental work initiated at the Bureau and seeing that the work is transferred to the public arena. These Centers have an amazing track record of producing research which finds its way promptly into the private sector for the benefit of the general public, business and industry and all levels of government.

To illustrate what a private-sector organization does in assisting in the transfer of the Bureau's technology: - ASHRAE develops and distributes design information and voluntary consensus standards to support the buildings industry. ASHRAE has received its greatest visibility due to the attention given its Standard 90 "Energy Conservation in New Building Design" which has now been adopted in whole or in part by 48 states as part of their state and/or local building codes and standards. This work had its origin at the

National Bureau of Standards where the Center for Building Technology developed design and evaluation criteria for energy conservation in buildings in response to the 1973 energy crisis. With this as a point of departure, ASHRAE Standard 90 was developed and first released in 1975.

Standard 90 illustrates clearly the importance of the basic, generic nature of the research conducted at the Bureau's Center for Building Technology. Energy conservation in buildings requires an overall approach including all aspects of building systems - such as lighting, heating and cooling equipment, system designs, and materials (structural, insulating, glazings, etc.) No single industry in the private sector has the broad-based interests necessary for the overall problem. A piece-meal, industry-by-industry approach would not have provided the necessary integrated approach required to achieve the desired conservation results in buildings as did ASHRAE Standard 90.

Standards development in the private sector by the voluntary consensus process is costly involving the commitment of significant resources. For example, in the development of Standard 90, some 120 nationally recognized experts representing the various specialties involved in overall building systems provided the necessary time commitment. The various working groups met numerous times to conduct their work involving substantial travel costs along with required staff support, printing and publication costs, etc. Most of these costs were borne by the private sector.

In addition, ASHRAE has some 55 active standards, most of which are directed to test methods and procedures for building components. These standards developed within the private sector using the voluntary consensus process are, in turn, employed by various groups in performance evaluation or certification purposes. A listing of ASHRAE standards based on information in whole or in part developed at the Bureau is attached to this letter.

There are two other points in regard to the research capabilities and activities currently carried out by the Bureau. If the two Centers at the Bureau were to cease, funds would not be available to pick up that activity within ASHRAE, and we are not aware of any other organization or group of organizations within the private sector capable of assuming the responsibility. ASHRAE is unique among the technical societies in that it sponsors approximately $1 million dollars in fundamental research each year. Most of these funds are raised by its members throughout the country through private-sector contributions. All of these funds are directed to research projects (without any overhead deductions) in the various technical areas related to building systems. The results of the research conducted at the Bureau and the research sponsored by ASHRAE reaches the design professionals through the design criteria published in the ASHRAE handbooks, technical papers at the ASHRAE national meetings and the development of standards. These funds are now used to complement and supplement some of the work of the Bureau and could not be expanded to adequately substitute for the Bureau's activities. The Center for Building Technology and the Center for Fire Research conduct about $18 million dollars (including external sources) annually in research. Perhaps as much as half is concentrated in areas of direct concern to ASHRAE. ASHRAE's research sponsorship cannot be expanded to substitute for the NBS effort.

The other consideration which should be addressed is: "To where would the Nation turn for a focal point or cadre of experts in building or fire technology?" If the NBS Centers are terminated or if their activities were seriously impaired, the talent currently located at NBS would be scattered. No central national capability would exist. ASHRAE, for example, has expertise; but its expertise resides within the ranks of its members, which are spread throughout the Nation. No full-time central staff of technical experts exists within ASHRAE.

Continued cooperation between the Center for Building Technology/Center for Fire Research and ASHRAE is important to the nation's building technology applications.

Thank you for the opportunity to express our support. Please let us know how we can help further.

Very truly yours,

Clinton W Phillips

Clinton W. Phillips
President

cc: Frank M. Coda
A. T. Boggs

ASHRAE STANDARDS BASED ON NBS WORK

13-69	Household Refrigerators. Combination Refrigerator-Freezers and Household Freezers, American National Standard Method of Testing
15-78	Safety Code for Mechanical Refrigeration
16-69	Methods of Testing for Rating, Room Air Conditioners
18-79	Methods of Testing for Rating, Drinking-Water Coolers with Self Contained Mechanical Refrigeration Systems
23-78	Mechanical Refrigeration Installation on Shipboard
35-76	Desiccants for Refrigerant Drying, Methods of Testing
41.1-74	Standard Measurements Guide: Section on Temperature Measurements
52-76	Methods of Testing Air-Cleaning Devices used in General Ventilation for Removing Particulate Matter
93-77	Methods of Testing to Determine the Thermal Performance of Solar Collectors
94-77	Methods of Testing Thermal Storage Devices Based on Thermal Performance
95-1981	Methods of Testing to Determine the Thermal Performance of Solar Domestic Water Heating Systems
96-1980	Methods of Testing to Determine the Thermal Performance of Unglazed Flat-Plate Liquid-Type Solar Collectors
100.2-1981	Energy Conservation in Existing Buildings - High Rise Residential
100.3 Proposed	Energy Conservation in Existing Buildings - Commercial
100.4 Proposed	Energy Conservation in Existing Buildings - Industrial
100.5-1981	Energy Conservation in Existing Buildings - Institutional
100.6-1981	Energy Conservation in Existing Buildings - Public Assembly
103-1982	Methods of Testing for Heating Seasonal Efficiency of Central Furnaces and Boilers
114 Proposed	Energy Management Control Systems Instrumentation
115 Proposed	Methods of Testing for Rating Air Source Heat Pump Water Heaters
116 Proposed	Methods of Testing for Seasonal Efficiency of Unitary Air-Conditioners and Heat Pumps

United McGill
Corporation
United Sheet Metal 200 East Broadway, Westerville, Ohio 43081, 614/882-7401, Telex: 245-357

April 7, 1983

Reply to: 12106 Mackell Lane
Bowie, Maryland 20715
Phone: 301/262-8032

Honorable Doug Walgren
Chairman of the Science, Research and Technology Subcommittee
U. S. House of Representatives
Washington, D. C. 20515

Dear Mr. Chairman:

On behalf of my Company, I would like to take this opportunity to register our continue support of the National Bureau of Standards Center for Fire Research and Center for Building Technology.

As you can see from the enclosed Corporate brochure we are a manufacturer with facilities throughout the United States. Our support for these Centers is based on the need to have a centralized center for fire and building technology. The private sector, of which we are part, is not in a position to step in and fill the void if these Centers were eliminated or reduced drastically. With the press of foreign influences, it becomes even more important to continue these Centers.

Presently, the Center of Fire Research is working on projects that would have direct application to the heating, ventilating and air conditioning (HVAC) field which we are a part. They also serve as a central focus for objective research and development. Additionally, the Center for Building Technology establishes the basis for traceability of performance standards of equipment used in the HVAC field.

I appreciate this opportunity to voice our support for these two vital Centers.

Sincerely,

Jerry Iacouzze /so

Gerald Iacouzze
Liaison & Technical
Services Engineer

GI/so
Enclosure

cc: K. Scott

ASPHALT ROOFING MANUFACTURERS ASSOCIATION 6288 Montrose Road, Rockville, Maryland 20852 (301) 231-9050

April 8, 1983

Honorable Doug Walgren, Chairman
Subcommittee on Science, Research &
  Technology
Committee on Science and Technology
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

The Asphalt Roofing Manufacturers Association (ARMA) appreciates the opportunity to have the ARMA position made a part of the Subcommittee's record on the fiscal year 1984 budget for the National Bureau of Standards. We particularly direct your attention to the ARMA interest in reauthorizing a financial commitment to maintain the Center for Building Technology (CBT) and the Center for Fire Research (CFR).

The Asphalt Roofing Manufacturers Association is the national trade association representing the major manufacturers of asphalt roofing products -- shingles and roll goods. ARMA member companies supply 80% of the roofing needs for America's housing and 60% of the roofing for commercial, industrial and institutional uses.

Continuing research and information results in improvements in construction technology to the advantage of both the industry and the consumer. Therefore, ARMA strongly believes that it is in the best interest of all sectors of the shelter industry -- as well as the consumer -- to reauthorize appropriate budgets for both the Center for Building Technology and the Center for Fire Research within the fiscal year 1984 budget for the National Bureau of Standards. Both these agencies provide unique research capabilities and sources of information which would be most difficult to duplicate in or by the private sector.

The Administration's proposed elimination of funding for the two Centers could cause a void in research and the development of innovative technology presently available through these Centers. It seems to us that the expenditure of the $9 million included in the proposed budget is a sound investment with proven constructive results.

Building research is budgeted at $3.17 million and fire research at $5.89 million. The Laboratory work by the Centers has saved many more dollars than expended and has prevented structural and fire related problems that might have otherwise arisen.

ARMA agrees with your comments expressed in your opening remarks at the Hearing on March 22, 1983:

> "Our preliminary analysis of the budget shows several trends. With respect to the support of basic research, a major turnaround has taken place in the Administration's policy. The feeling that basic research should absorb its share of the cuts being experienced by the other domestic programs has been abandoned in favor of large increases for selected basic research programs. However, those increases are accompanied by an absence of new initiatives in applied research and technology development, and substantial cutbacks in the existing programs in this category. Specifically, several major programs at the National Bureau of Standards, which have had the strong support of this Subcommittee in recent years would be eliminated entirely while some of the initiatives enacted into public law under the Stevenson Wydler Law are not moving forward. Proposed for outright elimination are the Center for Fire Research and the Center for Building Technology. The Fire Research Center was established by legislation which originated in this Subcommittee in 1973. We are not aware of any views from the fire community that this research work can be turned over to the private sector as proposed, and we are very much aware of the value of the research for fire prevention. The Building research Center provides much needed information on a wide range of materials that go into today's modern, residential, office, and industrial buildings. In addition, the need for an independent, high-quality source of advice and analysis on building technology questions was demonstrated when the Kansas City hotel collapse took place, killing scores of people, and the Bureau of Standards was called in to investigate its causes."

The ARMA has been able to provide the industry with technical information which would not have been possible without the testing capabilities and personnel expertise of the Center for Building Technology.

One of our major research efforts was with built-up roofing systems (BUR). Substantial knowledge has been gained about these systems as a result of research efforts assisted by the CBT. As a part of our statement, we have attached a listing of research performed by the Center for Building Technology, some of which ARMA sponsored.

In addition, ARMA maintains an extremely active interest in fire research and technology. Considerable time and effort by the Association is devoted to fire safety working with local and state fire officials. The Center for Fire Research has expertise simply not available on the local level. Testimony by others has specifically cited that it is unlikely any private sector institution or organization could or would provide the research, information and assistance presently available through the CFR. We are quite concerned over the proposal to eliminate the Center for Fire Research.

In conclusion, the Asphalt Roofing Manufacturers Association respectfully requests that the Subcommittee look favorably on our comments. Considering the supporting information which has been made available through the hearings and comment period, as well as the proven "Track records" of the CBT and CFR, reauthorization of the Center for Building Technology and Center for Fire Research is a practical and wise move by the Congress.

We will be delighted to respond with further information as to our experiences with both Centers if such material will be helpful in your deliberations and in support of the budget reauthorization.

Sincerely,

Richard D Snyder

Richard D. Snyder
Executive Vice President

RDS/kg

LISTING OF

ROOFING RESEARCH PROJECTS

PERFORMED BY

THE NATIONAL BUREAU OF STANDARDS

April 8, 1983

STATE-OF-THE-ART OF STRUCTURAL TEST METHODS FOR WALLS, FLOORS, ROOFS, AND COMPLETE BUILDINGS NBS Building Science Series 58
C.W.C. Yancey and L.E. Cattaneo
U.S. DOC/NBS Issued November 1974

Information of the structural testing of building components for the purpose of documenting information applicable to structural test method development and what research is needed for improvement of present test practice.

THE PERFORMANCE OF ROOFING MADE WITH ASPLUND FELTS
NBS Technical Note 477
S.H. Greenfeld
U.S. DOC/NBS Issued March 1969

Study of durability and performance of roofing made with Asplund wood fibers.

ATMOSPHERIC EMISSIONS FROM ASPHALT ROOFING PROCESSES
R.W. Cerstle; PEDCo-Environmental, Inc.
Prepared for National Environmental Research Center
Distributed by: NTIS/U.S. DOC October 1974

Description of asphalt roofing manufacturing processes and types of air pollution control devices applied to them.

PROPERTIES OF 21 YEAR OLD COAL-TAR PITCH ROOFING MEMBRANES: A COMPARISON WITH THE NBS PRELIMINARY PERFORMANCES CRITERIA
R.G. Mathey & W.J. Rossiter, Jr.
U.S. DOC/NBS Issued June 1977

Properties of coal-tar pitch roofing membranes approximately 21 years old were compared to properties of new membranes on buildings subjected to different maintenance procedures.

INTERIM REPORT ON PROJECT 4847 STANDARDS FOR BUILT-UP ROOFS
National Bureau of Standards Report 5422
W.C. Cullen, L.R. Kleinschmidt, H.R. Snoke
U.S. DOC/NBS Issued ?

Results of field studies of 101 low-pitched, mineral-surfaced, asphalt and coal-tar pitch, built-up roofs in the Western, Mid-Western and Eastern States.

NATURAL WEATHERING OF MINERAL STABLIZED ASPHALT COATINGS ON ORGANIC FELT NBS Building Science Series 24
U.S. DOC/NBS Issued October 1969

Study of long term outdoor weathering and the effects of mineral additives on the durability of coating-grade roofing asphalts.

HAIL RESISTANCE OF ROOFING PRODUCTS
Building Science Series 23
S.H. Greenfeld
U.S. DOC/NBS Issued August 1969

An evaluation as to the hail resistance of roofings.

THE EFFECT OF MOISTURE OF THE HEAT TRANSFER PERFORMANCE OF INSULATED FLAT-ROOF CONSTRUCTIONS NBS Building Science Series 37
F.J. Powell & Henry E. Robinson
U.S. DOC/NBS Issued October 1971

I. How much insulating performance of conventional constructions having insulation over concrete decks, was affected by moisture.
II. Investigation of properties of materials, their arrangement and dimensions which would yield a construction having an adequate degree of self-drying ability combined with low winter moisture regain rate.

EFFECTS OF MOISTURE IN BUILT-UP ROOFING - A STATE-OF-THE-ART LITERATURE SURVEY NBS Technical Note 965
H.W. Busching, R.G. Mathey, W.J. Rossiter, Jr., W.C. Cullen
U.S. DOC/NBS Issued July 1978

Review of literature which describes performance of roofing materials and systems as they are affected by moisture.

SOLAR HEATING, RADIATIVE COOLING, AND THERMAL MOVEMENT - THEIR EFFECT ON BUILT-UP ROOFING NBS Technical Note 231
W.C. Cullen
U.S. DOC/NBS Issued December 1963

Presents temperature data on several built-up roof systems when exposed to natural solar heating and radiative cooling during summer and winter seasons in Washington, D.C. and discussion in terms of roof performance. Furnishes data on thermal expansive and contractive characteristics of a composite built-up membrane and relation of these to performance of roof membrane.

LUBBOCK TORNADO: A SURVEY OF BUILDING DAMAGE IN AN URBAN AREA
NBS Technical Note 558
N.F. Somes, R.D. Dikkers & T.H. Boone
U.S. DOC/NBS Issued March 1971

Survey of building damage in the aftermath of tornado which hit Lubbock, Texas with conclusions as to reducing damage observed.

HURRICANE CAMILLE: AUGUST 1969 NBS Technical Note 569
R.D. Dikkers, R.D. Marshall
U.S. DOC/NBS Issued March 1971

Survey of structural damage caused by Hurricane Camille and suggestions as to improvement of building design and construction practices.

THERMAL-SHOCK RESISTANCE FOR BUILT-UP MEMBRANES
Building Science Series 9
W.C. Cullen & T.H. Boone
U.S. DOC/NBS Issued August, 1967

Laboratory data on some engineering properties of conventional bituminous built-up membranes and relations to performance desired of roofing systems operating under service conditions.

LABORATORY-FIELD COMPARISONS OF BUILT-UP ROOFING MEMBRANES
NBS Technical Note 473
T.H. Boone, L.F. Skoda & W.C. Cullen
U.S. DOC/NBS Issued December 1968

Comparison of values of engineering properties and thermal-shock resistance factor of roofing specimens under closely controlled lab conditions with technicians and under job-site conditions with roofers.

FATIGUE TESTS OF BITUMINOUS MEMBRANE ROOFING SPECIMENS
NBS Technical Note 863
G.F. Sushinsky & R.G. Mathey
U.S. DOC/NBS Issued April 1975

Measurement of the tensile and flexural fatigue strengths of conventional roofing membranes, develop methods of tests for measuring these engineering properties and recommend levels of performance.

PRELIMINARY PERFORMANCE CRITERIA FOR BITUMINOUS MEMBRANE ROOFING
NBS Building Science Series 55
R.G. Mathey & W.C. Cullen
U.S. DOC/NBS Issued November 1974

Research to identify and describe quantitatively the attributes which would be required of bituminous membrane roofing to assure their adequate performance in the varied climates of the U.S.

HAIL RESISTANCE OF ROOFING PRODUCTS NBS Report 9871
S.H. Greenfeld
ARMA/U.S. DOC/NBS Issued July 1968

An evaluation as to the hail resistance of roofings.

PROGRESS IN THE DEVELOPMENT OF A THERMAL-SHOCK RESISTANCE FACTOR FOR BITUMINOUS BUILT-UP ROOFING MEMBRANES (Paper 169)
W. C. Cullen & T.H. Boone
NBS Issued 1966

Lab data on some engineering properties of conventional bituminous built-up membranes and relate this data to the performance desired of roofing systems operating under service conditions.

THERMAL RESISTANCE MEASUREMENTS OF A BUILT-UP ROOF SYSTEM
NBSIR 80-2100
S.J. Treado
U.S. DOC/DOE Issued October 1980

Identification of factors which affect the thermal performance of existing built-up roof systems and description of technique for measuring the thermal resistance of roof systems.

SLIPPAGE OF BUILT-UP ROOF MEMBRANES - CAUSES AND PREVENTION
NBS Report 10,950
A.P. Cramp, W.C. Cullen, M. Tryon
U.S. DOC/NBS Issued November 1972

Results of laboratory research as well as field observations of membrane slippage in service; causes of slippage; suggestions on reducing the incidence of slippage.

A STUDY OF THE VARIABLES INVOLVED IN THE SATURATING OF ROOFING FELTS
Building Science Series 19
S.H. Greenfeld (ARMA)
U.S. DOC/NBS Issued June 1969

The study of degree of saturation of #27 felt with a typical roll saturant and a #55 felt with roll, mixed and shingle saturants.

EFFECT OF INSULATION ON THE SURFACE TEMPERATURE OF ROOF MEMBRANES
NBSIR 76-987
W. J. Rossiter, Jr., R.G. Mathey
U.S. DOC/NBS Issued February 1976

Study of surface temperature of black, grey and white roofs containing various amounts of insulation.

THE VISCOSITIES OF ROOFING ASPHALTS AT APPLICATION TEMPERATURES
NBS Building Science Series 92
W.J. Rossiter, Jr. , R.G. Mathey
U.S. DOC/NBS Issued December 1976

To develop a viscosity criterion for the application of asphalt in the fabrication of built-up roofing membranes.

MATERIALS FOR BUILT-UP ROOF COVERINGS STANDARD FOR SAFETY UL 55A
U/L Issued August 1978

Basic safety requirements for products covered by U.L. in the category of built-up roof coverings.

GUIDELINES FOR THE INSTALLATION OF SOLAR COMPONENTS ON LOW-SLOPED ROOFS NBS Technical Note 1134
R.G. Mathey, W.J. Rossiter
U.W. DOC/NBS/DOE Issued November 1980

Installation of solar equipment on existing low-sloped roofing systems, attachment to roof and wind uplift, evaluating existing roofing condition. Some guidelines applicable to installation on new roofing systems.

BUILDING RESEARCH AT THE NATIONAL BUREAU OF STANDARDS 1968-1974
NBS Building Science Series 75
N. Gallagher
U.S. DOC/NBS Issued March 1979

Description of changes that took place in National Bureau of Standards building research activities from 1968-1974.

APPENDIX V

INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOG

STATEMENTS AND LETTERS

GENERAL TECHNOLOGY APPLICATIONS, INC.
Suite 1015
1901 North Ft. Myer Drive
Arlington, Virginia 22209

Telephone: 703 522-2808

February 7, 1983

The Honorable Don Fuqua
2269 Rayburn House Office Bldg.
Washington, DC 20515

Dear Congressman Fuqua:

GTA specializes in innovative high technology -- particularly those technologies which are dependent on chemical processes. From the perspective of this firm's interests, I was nonplussed to discover that the Administration is proposing to reduce the funding of the Institute for Computer Sciences and Technology.

The Institute, which is part of the National Bureau of Standards, is working in an area which is critical to the functioning of the American economy. The sector in which my firm works -- chemical processes -- is especially dependent on computers and related products. ICST's activities in standardizing automated data processing equipment have been instrumental both in increasing the productivity of this sector domestically and facilitating the export of the technologies. What is most impressive about ICST's efforts is that they have been accomplished without imposing burdens on the involved industries.

While I cannot speak for other industrial sectors, I assume that ICST's work has a similar impact on industries such as travel and most manufacturing. At a time when productivity and balance-of-trade are among our foremost problems, this particular budget reduction seems especially counterproductive.

Yours truly,

Wm. Weitzen

Wm. Weitzen
Chairman of the Board

RECEIVED
FEB 15 1983
COMMITTEE ON SCIENCE
AND TECHNOLOGY
FEB 15 1983

ROBERT S. ROUSSEY
69 WEST WASHINGTON STREET
CHICAGO, ILLINOIS 60602

February 9, 1983

RECEIVED
FEB 2[illegible] 1983
COMMITTEE ON SCIENCE
AND TECHNOLOGY

The Honorable John Fuqua
The United States House of
Representatives
Chairman, Science and Technology
Committee of the House
2269 Rayburn House Office Building
Washington, D. C. 20515

Dear Mr. Fuqua:

In view of your interest in computer security issues, I would like to express my confidence in the work of the National Bureau of Standards' Institute for Computer Science and Technology.

I have worked with the people at the Institute and have participated with them in various projects. Their standards and publications are of continuing interest and importance in this computer revolution, and their work needs to be continued. During the last several years, I have also been working with the GAO and the OMB on internal controls in the federal government, and thus, I have firsthand knowledge as to the extensive work being done in this area.

Over the next decade, the technological changes in computers and their effect on internal controls will be enormous. An organization like the NBS Institute can play a significant role in establishing the appropriate controls and security over computer operations in the federal government.

I personally believe this role should be considered carefully when determining budget requirements for the National Bureau of Standards.

Very truly yours,

Robert S. Roussey

NAS

ROBERT S. ROUSSEY
69 WEST WASHINGTON STREET
CHICAGO, ILLINOIS 60602

SRT

February 9, 1983

FEB

The Honorable Doug Walgren
The United States House of
Representatives
Chairman, Science Research and
Technology Subcommittee of
the Science and Technology
Committee of the House
117 The Cannon House Office Building
Washington, D. C. 20515

Dear Mr. Walgren:

In view of your interest in computer security issues, I would like to express my confidence in the work of the National Bureau of Standards' Institute for Computer Science and Technology.

I have worked with the people at the Institute and have participated with them in various projects. Their standards and publications are of continuing interest and importance in this computer revolution, and their work needs to be continued. During the last several years, I have also been working with the GAO and the OMB on internal controls in the federal government, and thus, I have firsthand knowledge as to the extensive work being done in this area.

Over the next decade, the technological changes in computers and their effect on internal controls will be enormous. An organization like the NBS Institute can play a significant role in establishing the appropriate controls and security over computer operations in the federal government.

I personally believe this role should be considered carefully when determining budget requirements for the National Bureau of Standards.

Very truly yours,

Robert S. Roussey

NAS

JOHN J. McMULLEN ASSOCIATES, INC.
NAVAL ARCHITECTS/MARINE ENGINEERS/TRANSPORTATION CONSULTANTS
Century Building, Suite 715, 2341 Jefferson Davis Highway, Arlington, Virginia 22202
Telephone: 703-521-6500

February 15, 1983

Mr. Don Fuqua
United States House of Representatives
2269 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Fuqua:

John J. McMullen Associates, Inc. is one of the world's largest naval architectural firms. The company designs many ships for the U.S. Navy and for commercial clients. We have formed a company computer standards committee to further improve our extensive use of computers for both business and technical analysis and design.

I was distressed to hear that the budget for the Institute for Computer Sciences and Technology (ICST), Bureau of Standards has been cut for the coming fiscal year. As an ADP equipment user, JJMA believes that the work the Institute performs in the area of hardware and software standards is important in promoting the compatibility and portability of existing ADP equipment and accompanying software.

The standards and guidelines published by ICST are utilized by private industry as well as the Federal government. ICST sponsors workshops and conferences which are well attended by private industry personnel, further promoting the transfer of high technology from government to industry.

Very truly yours,

JOHN J. McMULLEN ASSOCIATES, INC.

Richard W. Thorpe
Executive Vice President

RECEIVED
FEB 23 1983
COMMITTEE ON SCIENCE AND TECHNOLOGY

FEB 23 1983

RWT/acl

NASIS

NATIONAL ASSOCIATION FOR STATE INFORMATION SYSTEMS

P.O. BOX 11910 LEXINGTON, KENTUCKY 40578 (606) 252-2291

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JACK STANTON
Arizona

President-Elect
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Standards
DALE L. NELSON
Iowa

Management Policies & Procedures
FRANKLIN D. JOHNSON
Connecticut

STAFF

Executive Director
CARL VORLANDER

Executive Assistant
JUDIE PARISH

February 16, 1983

The Honorable Don Fuqua
Chairman, Commitee on Science & Technology
House of Representatives
2321 Rayburn House Office Buildng
Washington, D.C. 20515

Dear Congressman Fuqua:

It appears that proposed budget cuts for the Institute for Computer Science and Technology, Department of Commerce, National Bureau of Standards, will have an adverse effect on the states' and local governments' application of information processing and telecommunications technology. During the past two years a major channel of communication has been established between ICST and the states to provide vitally needed interaction in the development of automated/telecommunication standards which impact all levels of government.

NASIS has been a prime participant and supporter of this two-way interaction. We are fearful that the initial progress being made in the exchange and transfer of information and technical assistance will adversely impact the states at a time when we in the states are trying to intelligently assume our proper responsibilities and allow compatability among the states, vendors and the federal government.

Since automation presents the best opportunity to enhance productivity within all levels of government, we ask that you favorably consider and support sufficient funding to allow ICST to effectively interact with us.

Sincerely,

Jack Stanton

JACK STANTON
President

RECEIVED
FEB 25 1983
COMMITTEE ON SCIENCE
AND TECHNOLOGY

cc: Carl Vorlander, Executive Director
NASIS Officers

Touche Ross & Co.

February 17, 1983

Representative Don Fuqua
Chairman-Science & Technology
Committee
2269 Rayburn House Office Building
Washington, D.C. 20515

SUBJECT: BUDGET FOR CENTER FOR PROGRAMMING SCIENCE AND TECHNOLOGY

Dear Sir:

- Microcomputers are exploding all over the country
- Millions of people are entering the computer field every year
- Computer Security - always a fragile area - it is more deserving than ever of national attention
- National standards are more important than ever for computer security and integrity

The most objective source for national standards in this critical field in time is the Center for Programming Science and Technology of the National Bureau of Standards. Because of the explosion in micros, and their accesses they have to corporate data bases, standards for security are more essential than ever. The budget and the work of the Center is greatly needed - please support it.

By way of introduction, I have been a specialist in the field of computer security for 20 years. I am an author of one of the most widely used texts on the subject, COMPUTER CONTROL & AUDIT, published by the Institute of Internal Auditors, and I am currently leading my firm, Touche Ross & Co., in the microcomputer field. To the best of my knowledge, Touche Ross & Co. has not been and is not planning to be a vendor to the Center.

Your support in this vital field of computer security is truly needed.

Regards,

Donald R. Wood

Donald R. Wood

DRW:ls

RECEIVED
FEB 23 1983
COMMITTEE ON SCIENCE
AND TECHNOLOGY

Tektronix
COMMITTED TO EXCELLENCE

Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97077

Phone: (503) 627-7111
TWX: 910-467-8708
TLX: 15-1754

February 18, 1983

Hon. Don Fuqua
2269 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Fuqua,

As you examine the new Federal budget and weigh the costs and benefits of various programs, I would like to ask that one small but important item does not escape your notice.

The Institute for Computer Science and Technology within the National Bureau of Standards has performed a vital service to industry in the area of computer data communications. The Institute has been a catalyst for bringing about standards that will be beneficial to both the industry and the Federal Procurement procedures. These standards are being formulated in conjunction with the computer industry in this country. The Institute has also been active in promoting these standards overseas so that American products abiding by the standards should not experience trade barriers in foreign markets.

I would like to see this vital work continue and would, therefore, ask that the Institute for Computer Science and Technology be funded a least, at present levels.

Sincerely,

William D. Walker
Executive Vice President

WW/MG/vp

RECEIVED
MAR - 8 1983
COMMITTEE ON SCIENCE
AND TECHNOLOGY

STATE OF FLORIDA
DEPARTMENT OF
GENERAL SERVICES
Larson Building, Tallahassee 32301
Thomas R. Brown, Executive Director

DIVISIONS
- ADMINISTRATION
- BOND FINANCE
- BUILDING CONSTRUCTION AND PROPERTY MANAGEMENT
- COMMUNICATIONS
- ELECTRONIC DATA PROCESSING
- MOTOR POOL
- PURCHASING
- SECURITY
- SURPLUS PROPERTY

Please address reply to

112 Bloxham Building
Tallahassee, FL 32301

February 23, 1983

Representative Don Fuqua
Chairman Committee on Science and Technology
2321 Rayburn House Office Building
Washington, D.C. 20515

Dear Representative Fuqua:

As a member of the State and Local Government Planning Committee, it has come to my attention the 1984 budget for the Institute for Computer Science and Technology, Department of Commerce, National Bureau of Standards is being cut from $10 million to $3 million.

A seventy percent (70%) reduction of the Institute's operating budget will destroy their ability to continue its excellent program.

In my opinion, their leadership and representation of the user community in the development of information processing standards is an important and cost-effective entity.

Any favorable consideration you can provide to properly funding the Institute is particularly important to the State and Local Governments's information processing activities.

Sincerely,

J. Robert Ippolito, D.P.A.
Director
Division of Electronic Data Processing

JRI/bbe

RECEIVED
#18 3-9-83 extended by gail
MAR - 2 1983
COMMITTEE ON SCIENCE AND TECHNOLOGY

Coopers
&Lybrand

certified public accountants

1251 Avenue of the Americas
New York New York 10020

telephone (212) 536-2000
telex 126496
cables Colybrand

in principal areas of the world

February 23, 1983

The Honorable Don Fugua
House of Representatives
Chairman, Science and
Technology Committee
2269 Rayburn House Office Bldg.
Washington, D.C. 20515

Dear Sir:

It has come to my concerned attention that your Committee has oversight of and interest in the budget of the National Bureau of Standards. Within NBS there are activities of considerable interest to me and to Coopers & Lybrand. Because of C&L's leadership in the use of computers in auditing, we have become especially interested in the Institute for Computer Sciences and Technology.

Its pioneering work with computer controls and security have been exemplary and unique. Since this work leads to standards, both the result and the content of their efforts point to two major unsolved problems of today; the problem of computer crime and abuse, and the problem of uncoordinated and wasteful computer use.

As business problems, these are important and costly to those whose organizations are centered in the computer.

I urge you to investigate the appropriation to the Institute for Computer Sciences and Technology/NBS, and assure that their fine work not only continues, but is able to yield its important results.

Your truly,

Stanley D. Halper

Stanley D. Halper
National Director
CAAG/EDP Development

SDH:es

RECEIVED
MAR - 7 1983
COMMITTEE ON SCIENCE
AND TECHNOLOGY

CITY OF CLEARWATER
POST OFFICE BOX 4748
CLEARWATER, FLORIDA 33518

CITY MANAGER

February 24, 1983

The Honorable Don Fuqua
Congressman - District 2
2269 Rayburn Building
Washington, DC 20515

Dear Congressman Fuqua:

It has come to my attention that the 1984 Budget for the Institute for Computer Science and Technology, Department of Commerce, National Bureau of Standards, has been drastically cut.

This organization conducts a very active program with state and local governments that provides technical assistance and distribution of information concerning the latest developments in information processing and telecommunication technology. Their leadership and representation of the user community in the development of information processing standards is unique and unsurpassed by any other government or industry organization. It would be a significant loss to the state and local governments if this program had to be discontinued.

Any favorable consideration you may give this matter will be appreciated.

Very truly yours,

Anthony L. Shoemaker

Anthony L. Shoemaker
City Manager

cc: Congressman Bilirakis
Congressman Young

RECEIVED
MAR - 3 1983
COMMITTEE ON SCIENCE
AND TECHNOLOGY

MAR 3 1983

Computer & Communications
Industry Association
Suite 512 1500 Wilson Boulevard
Arlington, Virginia 22209
(703) 524-1360

March 2, 1983

Honorable Douglas Walgren
Chairman
Subcommittee on Science,
Research and Technology
117 Cannon House Office Building
Washington, DC 20515

Dear Mr. Walgren:

I recently learned that your subcommittee has planned hearings on the Fiscal Year 1984 budget for the National Bureau of Standards during the third week of this month.

The Computer & Communications Industry Association (CCIA) strongly supports the Institute for Computer Sciences and Technology within the NBS and is disturbed by proposed ICST budget reductions. On February 22 of this year I testified at the hearings held by the Senate Subcommittee on Science, Technology and Space of the Committee on Commerce, Science and Transportation to voice those concerns.

On behalf of CCIA's 70 member companies I would greatly appreciate the opportunity to present testimony to the Subcommittee on Science, Research and Technology. The members of the Association firmly believe that the ICST is a necessary and beneficial organization whose current activities should not be hampered by a reduction in funding.

Enclosed, for your information and review, are some descriptive materials on the CCIA and its 70 member companies as well as a copy of my testimony from the Senate hearing. If I can provide additional information, please don't hesitate to call me.

Sincerely,

AGW Biddle

A. G. W. Biddle
President

AGWB/hh

Enclosures

THE FLORIDA LEGISLATURE
Joint Select Committee on Electronic Data Processing Systems

RECEIVED
#25 3-17-83
MAR 10 1983
COMMITTEE ON SCIENCE
AND TECHNOLOGY

SENATOR GEORGE STUART, JR.
CHAIRMAN
REPRESENTATIVE WINSTON W. "BUD" GARDNER, JR.
VICE-CHAIRMAN

JOHN C. HENDERSON, STAFF DIRECTOR
Room 27, Senate Office Building
Tallahassee, Florida 32301
Telephone (904) 488-4646

March 3, 1983

The Honorable Don Fuqua
The House of Representatives
2269 Rayburn House Office Building
Washington, D. C. 20515

Dear Congressman Fuqua:

It has come to my attention that the National Bureau of Standards has proposed a major budget cut for the Institute of Computer Science and Technology (ICST). As the Chairman of the Florida Legislature's Joint Select Committee on Electronic Data Processing, we are currently involved in assessing computer technology policy in Florida and have found the work of ICST to be very beneficial.

Specifically, our task forces (comprised of computer professionals from the private sector and universities) on Telecommunication and Small Systems Integration have used the ICST work on wide-area networks (open systems interconnect model) and local-area networks as a basis for the development of standardization policies and to establish a common planning framework within Florida government.

Both our task force members and professional staff have been very impressed with the quality of work performed at ICST. Furthermore, they believe the work in protocol standardization is critical. As policy-makers in the State of Florida, we completely concur.

The ICST not only provides a source of vendor-independent expertise, but it is in a unique position to represent the United States, and hence, individual states, in crucial international negotiations concerning communications and standardization. These standardization efforts will ultimately provide a framework that will ensure state policies are compatible with federal policies and both are in tune with the international community.

I might add that I believe the standardization efforts of ICST will also promote a competitive information technology market and thereby increase innovation. This will allow state governments to utilize competitive acquisition methods as a means to ensure reasonable prices.

Without a doubt, computer technology will be a key to increased productivity in the public sector. Further, high technology is a key to the economic growth of the United States, in general, and Florida in particular. I think we should invest more, not less, in independent, unbiased technological expertise such as the ICST. While I'm sure that private sector volunteers will contribute greatly to any ultimate standards, I think the Federal Government must exercise leadership in this effort. In my view, it is the only way to make progress while ensuring equal access for a variety of effected interests.

If I can provide further information concerning Florida's use of ICST work products or assist efforts to obtain adequate funding for ICST, please contact me.

Sincerely,

George

George Stuart, Jr.
Chairman

GS:ep

cc: Mr. Jesse Poore
Science and Technology Commission

Prime Factors

6529 Telegraph Avenue, Oakland, California 94609
(415) 654-5090

March 8, 1983

The Honorable Doug Walgren
Chairman, Subcommittee on Science,
Research and Technology
2319 Rayburn House Office Building
Washington, DC 20515

Dear Mr. Chairman:

It has come to my attention, via the Committee's news release and articles in trade publications, that the 1984 budget includes a significant reduction of funding for programs within the National Bureau of Standards.

I am writing to you in order to register my opinion about the validity and necessity of a particular section within Computer Science and Technology: The Cryptography group led by Dr. Dennis Branstad.

My experience in helping large corporations has shown me that there is a tremendous information gap between management who need to implement data encryption technology and the proper authorities who can provide secure methods. I believe that without the creation of the Data Encryption Standard and its support by the NBS, the results would have been chaotic. Data encryption algorithms are products of state-of-the-art mathematics. There is no possibility for the average corporate or communications manager to judge the quality of any given encryption algorithm.

The result is that our largest financial and commercial institutions employ the DES because they were given a choice between any number of unproven and perhaps insecure algorithms and the well-tried DES. In short, the very existence of the standard and its spinoff (EFT pro-protection) has made it possible to make a wise decision without being subject to a variety of vendor claims that would have crippled nearly every user of DES or related technology.

I believe that this standardization of cryptographic algorithms must continue to exist and diversify. Many private sector organizations are now employing software and firmware implementations of the DES. It would be extremely useful for the NBS to validate the correctness of these implementations. The very fact that NBS has provided a data set for testing of the DES (NBS Special Publication 500-20, "Validating the Correctness of Hardware Implementations of the NBS Data Encryption Standard") has made it possible for software and firmware users to verify the correctness of a purchased DES system and continue to verify the code throughout its use.

Finally, the necessity for good encryption systems cannot possibly stop with the DES. Someday it, like all high technology, will be obsolete. I have expected that the NBS will still function to provide a better standard and alternatives. A most important alternative will be the standardization of a public-key encryption algorithm. I believe it is essential that a secure and workable public-key system be adopted to ease many of the key management problems that can occur with algorithms such as the DES.

In summary, I am sure that the demand for secure cryptographic algorithms will increase. The ever-growing EFT use by our country's banking system is reason enough to consider cryptography a necessity. The creation of cryptographic algorithms is an art, not a science. In nearly every case the only way to "prove" that an algorithm is secure is to try to break it. I believe that the uneducated user of cryptographic technology will not accept vendor claims of secure algorithms (most non-DES algorithms are not even available for scrutiny). Therefore a trusted central authority will be required to maintain existing algorithms and coordinate the certification of new ones. The NBS has fulfilled this function in the past and I hope it will be able to continue to do so in the future.

Thank you for your time and consideration.

Sincerely,

Michael B. Schwartz
Principle

MBS/srb

Tektronix
COMMITTED TO EXCELLENCE

Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97077

Phone: (503) 627-7111
TWX: 910-467-8708
TLX: 15-1754

March 10, 1983

Congressman Don Fuqua
2269 Rayburn House of Representatives
Washington, D.C. 20515

Re: Fiscal Year-1984 NBS Budget Request

One of the items on the February 25, 1983 fact sheet from the Committee on Science and Technology discusses the budget reduction for the NBS Institute for Computer Science and Technology. The assumption is made that the standards setting activities of the Institute can be turned over to the voluntary standards setting bodies. I believe this would be false economy. The work of the Institute has been vital as a catalyst for the voluntary standards bodies. Without this catalyst, voluntary standardization would be seriously affected.

As an example of the kinds of service the Institute provides, consider the following. In February 1983, the Institute sponsored a workshop for selecting the options within an emerging protocol standard for local area networks. This workshop brought together representatives from 28 companies. In two days decisions were reached that would normally have taken years to achieve by random mechanisms. The savings for all attendees and for those who will benefit from the standard could be measured in the tens of millions of dollars.

I believe that the proposed budget cuts will seriously affect the voluntary standards setting processes in the United States and in the long run cost us much more than the modest saving in the proposed budget. I recommend that the Institute for Computer Science and Technology be set at least at the present levels of funding.

Sincerely,

Maris Graube

Maris Graube
Corporate Interface Engineer
Del. Sta. 50-473

cc: Robert Blanc

MG/vp

RECEIVED
MAR 16 1983
COMMITTEE ON SCIENCE
AND TECHNOLOGY

2801 Independent Square
Jacksonville, FL 32202

March 11, 1983

TO: Distribution List

SUBJECT: National Bureau of Standards Budget Hearings
March 22-23, 1983

Gentlemen:

As a practicing audit partner in a large CPA firm and one who is deeply involved in computer auditing, I would like to offer my comments on the role of NBS in the area. These comments are my own and are not meant to represent those of my firm.

Over the past 15 years, I have been heavily involved with EDP security, control and audit considerations with the American Institute of CPA's, Institute of Internal Auditors, EDP Auditors Association, and educational organizations at a national level -- as well as NBS. During this time, none of these private sector organizations have been able to either work together effectively in developing standards or keep up with the rapid growth of EDP technology and use. ADAPSO, DPMA and other professional EDP organizations are, in my opinion, in the same position. To a degree, they have been able to come together at NBS meetings which I have attended and through NBS Fips Pubs, but these have been too few and far between.

Given the enormous impact small and large computer systems do and will have on the entirety of our economy, I believe NBS should certainly be doing more in the computer standards, risk, security, etc. areas, and not less.

Sincerely,

Keagle W. Davis

Distribution Attached

MAR 16 1983

Distribution:

Senator Robert Packwood
Dirksen Office Building
Washington, D.C. 20510

Senator Sam Nunn
Dirksen Office Building
Washington, D.C. 20510

Senator Slade Gorton
Russell Senate Office Bldg.
Washington, D.C. 20510

Representative Don Fuqua ✓
2269 Rayburne House Office Bldg.
Washington, D.C. 20515

Representative Doug Walgren
117 Cannon House Office Bldg.
Washington, D.C. 20515

Representative Doug Walgren
House of Representatives
Committee on Science and Technology
Washington, D.C. 20515

The Chase Manhattan Bank, N.A.
1 New York Plaza
New York, New York 10081

MAR 21 1983

CHASE

March 11, 1983

The Honorable Doug Walgren, Chairman,
Subcommittee of Science, Research & Technology,
House of Representatives,
Room 2319 Rayburn House Office Building,
Washington D. C. 20515

Dear Sir:

The 1984 Budget reductions affecting the NBS Computer Science and Technology area concerns me deeply. The Institute for Computer Science and Technology, ICST has provided vital technical assistance to the banking community for banking standards and has also assisted our industry by applying reliable communications security techniques to banking applications. Voluntary technical expertise in communications security has been possible by this approach and is not readily available in the private sector. Both immediate and long range benefits have been provided by the ICST group.

U. S. Standards must not be controlled randomly. The private sector can never replace the position of the National Bureau in matters of handling standards in an area as vital as this is at this time. The Institute should continue to be maintained with sufficient resources to continue with technical excellence during a period of unpredictable computer demands world wide.

Respectfully Yours,

Richard Y. Yen
Second Vice President

AIM
ADVANCED INFORMATION MANAGEMENT INCORPORATED
...Computer security and privacy

March 14, 1983

The Honorable Doug Walgren
Chairman, Subcommittee on Science,
Research and Technology
Room 2319, Rayburn House
Office Building
Washington, DC 20515

MAR 18 1983

Dear Mr. Chairman:

I am writing in regard to the upcoming hearings to be held by your committee on the FY 1984 budget for the National Bureau of Standards and the possibility of severe cutbacks in the Bureau's programs for computer standards.

My company consults exclusively in the areas of computer and telecommunications security, privacy and disaster recovery planning. The client base for our consulting services consists primarily of leading Fortune 500 companies and Federal government agencies. We are leaders in the technology of securing sensitive systems and protection the information resource and rely heavily, as do our clients, upon the work being done by NBS.

I have been an outspoken proponent for years for more active government leadership and have endeavored to provide other alternatives to limited government funding in this important area. (see attached) Lack of such leadership has been demonstrably proven to have prolonged exceptionally serious problems in the security of computer systems and resulted in measurable harm to U.S. citizens. The efforts in this area by the National Bureau of Standards are irreplaceable and cannot be deferred without risking inordinate delay in providing solutions to these problems. The recent standards efforts by NBS in the areas of data encryption, message authentication and key management represent an extraordinary service for our nation which could not have been otherwise performed.

Funding in these areas needs to be expanded rather than curtailed. The cost penalties and potential for harm in curtailing the Bureau's important efforts in the area of computer security are enormous. These matters were the subject of a talk I presented last fall at a Brookings Institution Seminar on Computer Crime and Privacy with Congressman Nelson and Senators Mathias and Biden. I would welcome the opportunity to summarize these comments in testimony before your Committee in the hopes that the potential of these budget cuts can be seen in perspective with our national needs.

Sincerely,

Robert P Campbell
Robert P. Campbell, CDP
President

ADCU
Association of Data Communications Users
New York, N.Y.

REPLY TO:

March 14, 1983

MAR [illegible] 1983

The Honorable Doug Walgren
House of Representatives
Chairman, Subcommittee on Science,
Research and Technology
Washington, D.C. 20515

Dear Congressman Walgren:

I am writing, on behalf of the Association of Data Communications Users (ADCU), to express our support for the computer and communications standards activities of the National Bureau of Standards' Institute for Computer Sciences and Technology. We feel that ICST serves a vital function that is not being met by the private sector. A major problem with voluntary standard setting groups is their membership is primarily comprised of vendors and carriers, and therefore, users' interests are often not adequately represented. ICST takes much more of a user perspective in their efforts.

We at ADCU have used the services of ICST to disseminate information to our membership concerning the latest status, trends, and anticipated content of relevant standards. We feel it would be a disservice to the user community if ICST's budget was cut.

For your information, ADCU's membership consists of 160 companies, two-thirds of which are in the Fortune 500. Our primary objectives are to disseminate information and provide problem solving forums for our members. If you wish to contact me you can reach me at

Chase Manhattan Bank
1 New York Plaza, 17th floor
New York, N.Y. 10081

Ph. # 212-676-5204

Very truly yours,

Harvey S. Hershkowitz

Harvey S. Hershkowitz
Chairman
ADCU Standards Committee

MAR 21 1983

NASIS

NATIONAL ASSOCIATION FOR STATE INFORMATION SYSTEMS

P.O. BOX 11910 LEXINGTON, KENTUCKY 40578 (606) 252-2291

March 15, 1983

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JUDIE PARISH

Honorable Doug Walgren
Committee on Science and Technology
2321 Rayburn House Office Building
Washington, D. C. 20515

Dear Representative Walgren:

It has come to my attention that the 1984 budget for the Institute for Computer Science and Technology, Department of Commerce, National Bureau of Standards, has been cut drastically. This organization conducts a very active program with state and local governments that provides technical assistance and distribution of information concerning the latest developments in information processing and telecommunication technology.

The Institute for Computer Science and Technology's leadership and representation of the user community in the development of information processing standards is unique and unsurpassed by any other government or industry organization. It would be a significant loss to the state and local governments if this program had to be discontinued.

Any favorable consideration you can give this matter will be appreciated.

Sincerely,

Donald F. Kerstetter

Donald F. Kerstetter
Eastern Regional Director

DFK:mjp

MAR 21 1983

AMERICAN SATELLITE COMPANY
1801 RESEARCH BOULEVARD, ROCKVILLE, MARYLAND 20850 (301) 251-8300

March 16, 1983

The Honorable Doug Walgren
Chairman, Subcommittee on Science Research
and Technology
2319 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Chairman:

American Satellite Company is a leader in the development and use of advanced communications equipment. We are presently involved in developing security devices which can be used to greatly enhance the security and integrity of our domestic satellite communications systems. Communication security is fundamental to the continued well-being of our national economic and military positions in the world today. Some of the foundations of this security work has been laid by the technical staff of the Institute for Computer Sciences and Technology (ICST) at the National Bureau of Standards.

Based on our interactions with this group, we feel that ICST is a model of Federal leadership without interference, ICST's work has been critical to the development of national markets for us in the secure information communication industry. We feel that ICST's programs in areas such as computer and data communications security should continue to be funded at a level sufficient to maintain its technical base. Their work in this area has been demonstrated to have immediate payoffs and long-term benefits.

Sincerely,

Robert J. Ho
Manager, Digital Systems

/eb

MAR 22 198

DRAGON SYSTEMS, INC.
173 Highland St.
West Newton. MA 02165

March 18, 1983

The Honorable Doug Walgren
Chairman, Subcommittee on Science,
Research, and Technology
2319 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Walgren:

I am responding to your invitation to contact your Committee re: the critical need for at least maintaining the present funding levels in FY84 for the National Bureau of Standards, Institute for Computer Science and Technology. The proposed administration budget cut would largely preclude the realization of meaningful data processing standards so essential to both the creators and consumers of computer technology. There is scant evidence that the highly competitive and partisan private sector, at their own expense, will suddenly join arms and adopt statesmen-like attitudes in any all-voluntary standards setting process.

As a specific example, let me address the speech technology area in which I have been deeply involved for many years, and for which there are no standards. In the automatic speech recognition area alone, there is a rapidly burgeoning array of products, with system prices ranging from under $600. to over $60,000. Virtually all vendors "claim" performance at 99% or better - on tasks, in fact, which are ill-defined and certainly not comparable. In two different direct tests of the commercial systems available 18-24 mos. ago, actual system performance varied quite widely (see reprints enclosed). At present, customer procurements for this sophisticated technology fall easy prey. Furthermore, technological ignorance is the primary cause of R&D funds too often spent on ill-conceived applications and sub-optimal wheel re-inventions, rather than the meaningful advances so sorely needed.

After a decade's history of argumentative supposed speech "standards" activities within the speech technical community, meaningful output has been almost nil. By sharp contrast, however, the NBS ICST in March, 1982 sponsored a Workshop on Standardization for Speech I/O Technology which attracted excellent representation and effective participation from government, industry, and academia. As an outcome of that event, ICST has succeeded in initiating the first steps in meaningful consensus speech I/O standards. A draft Guideline for Speech Recognition Performance Evaluation generated through ICST is presently completing development and review. The fulfillment of these as well as the companion speech data base standards will be abruptly aborted without the continuing support of ICST.

Government military and non-military applications for speech I/O with synthesis, recognition, verification, and compression are extraordinarily broad. Significant increases in human productivity, security, intelligence, automatic machine control, and communications have already been clearly demonstrated with this rapidly maturing technology. In the unlikely event that the private sector were to develop realistic and timely standards, it is difficult to conceive that the U.S. government, probably this country's largest customer for this technology, would knowingly opt for having no voice in creating these standards. The implications of an en masse government abandonment of realistic computer technology standards in today's society are truly staggering. Given this context, the present administration's proposed NBS ICST budget cuts are not only manifestly "penny-wise and pound-foolish" but potentially dangerous.

Sincerely yours,

Janet M. Baker

Janet M. Baker, Ph.D.
President
DRAGON SYSTEMS, Inc.
173 Highland St.
West Newton, MA 02165
(617) 527-0372

Chairman of the IEEE
Working Group on Speech
I/O Technology Performance
Evaluation

JMB/bbr

NORMAN J. REAM
Certified Public Accountant

811 AVENIDA SAN JUAN EAST
SAN CLEMENTE, CALIFORNIA 92672
(714) 492-2438

March 18, 1983

Honorable Doug Walgren
Chairman of the Subcommittee on Science, Research and Technology,
House of Representatives, Washington, D.C.

Dear Mr. Chairman:

I appreciate this opportunity to express my views on the Administration's fiscal year 1984 budget proposal which is directed towards severely limiting the appropriations for the National Bureau of Standards applied research programs. I am deeply concerned that the Institute for Computer Sciences and Technology (ICST) is proposed to suffer a budget reduction of almost 70%. I am concerned further that the Administration is apparently suggesting that the private sector should and is capable of conducting the necessary research and development of those standards required by the Federal government.

I am submitting the following comments as an interested and concerned private citizen in the taxpayers and consumer interest.

I am a Certified Public Accountant by profession and have my own firm in California.

I have been closely associated with the field of information processing since joining IBM in 1947 as Director of Accounting Research at their New York headquarters. I was an executive of Lockheed Corporation from 1953 until 1965, serving as corporate policy official for the development of the advanced use of computers and related communications equipments within their family of companies.

In 1965 I was appointed the first Director of the now Institute for Computer Sciences and Technology at the National Bureau of Standards and developed the initial ICST standards program.

In November 1966 I was made a member of the Navy Secretariat and was the Computer and ADP Policy official for the Navy in addition to other duties.

I have had relationship with the ANS X3 Communications and Information Processing Committee since its inception in about 1962 in CBEMA. I was a member of the U.S. Delgation to the ISO Plenary Meeting in Tokyo in 1965 and have twice served as Chief Delegate of the United States Delegation (ANSI) to the ISOTC97/SC13 committee meetings in West Berlin.

I have observed with keen interest the continuing operational development of the ICST, from a slow and faltering first decade of existence to where, under its now Director, it has a well structured plan and program. Today, it is making a real and valued contribution to the Federal user organizations. To accomplish the ICST objectives and planned programs will not be easy and will require Federal user participation and cooperation.

However, if the ICST is totally restrained by ill-advised budget reductions then we can look forward to a continuance of questionable ADP procurements and uneconomic ADP and related communications operations within the Federal government.

In unembellished terminology, the following programs are re-required if the ICST is to successfully contribute to the exploding use of advanced information processing and related communication developments in the Federal government:

- Applied research programs
- Standards requirement indentification programs
- Standards development
- Federal user Education Program
- Standards Compliance Measurement Program
- Standards Evaluation Program

I would suggest that the pittance budget provision proposed by the Administration precludes adequate accomplishment of any of the above, singly or as a whole.

I must assume that the Administration in espousing that private industry would accomplish those activities that would of necessity be dropped by the ICST is primarily supporting the use of offices of the American National Standards Institute (ANSI) and the Computer and Business Equipment Manufacturers Association acting as the Secretariat for the ANSI X3. Neither ANSI or CBEMA are organized and/or staffed to accomplish those activities that have been assigned the ICST. The staff of ANSI is of an administrative nature and is not technically oriented. The same comments can be addressed to CBEMA. Both organizations rely on voluntary committee activities in development of voluntary ANSI standards.

A very negative factor in any attempt to rely on the ANSI/CBEMA mode of standards development is that GAO found that their development time for ADP standards averages between six to eight years. The Standards Study Team of the President's Reorganization Project stated:

> "Given the rapid rate at which the technology is moving this lengthy and cumbersome development process not only makes standards less than timely but also creates the danger that a given standard may be outdated by the time

> it is adopted. Overreliance on the voluntary standards process and domination of this process by large data processing equipment manufacturers have been cited as partial causes for delays in the development of standards, and have resulted in standards which do not necessarily meet the high priority needs of the Federal Government." [1]

Another major problem in attempting to rely on the ANSI voluntary standards program is the fact, admitted or not, that the ANSI program is extremely heavily influenced by a group of large U.S. based international systems manufacturers who are the major members of CBEMA. The previously referred to Standards Study Team stated:

> "Control of information processing standards by any one manufacturer or group of manufacturers would give such manufacturers undesirable control over the rest of the industry, and would have serious economic impacts internationally, as well as nationally.
>
> We also conclude that maintenance of the status quo in the standards program will lead to greater incidences of "limited competition" procurements, and that this is demonstrably undesirable. The relationship of standards to procurement makes it imperative that greater efforts be given to development of adequate measurement criteria for determining compliance to standards." 2

The ANSI voluntary standards program does not provide for any compliance measures. CBEMA has openly resisted the development of compliance measurement techniques, without which Federal standards are almost useless - as are ANSI voluntary standards as applied to Federal operations.

A major flaw in the ANSI method of approval of ANSI standards is their stated requirement of the development of evidence of consensus by those concerned with a proposed standard. However, ANSI does not define the term "consensus". In 1978 the ANSI Board of Standards Review published the following:

> "There are basically two aspects to each case which we address. First, is there evidence that procedures of due process have been followed. In general that means that all concerned parties have had an opportunity to be heard, that an attempt was made to resolve problems, that conflict with other American National Standards was resolved, that other standards have been given due consideration and that ANSI procedures have been complied with. If we find that these have not been met the standard is sent back.
>
> If they have been met then BSR must determine from the final voting results of those concerned, whether consensus exists, that is whether a substantial agreement has been reached by those concerned with a particular standard. Without such substantial agreement approval of a voluntary standard by ANSI would be meaningless and deceptive.
>
> You will note that no numerical values are given in the definition of consensus. The BSR does not look for any fixed percentage of votes for or against. We have had cases where a single negative from a party vitally affected by a proposed standard has indicated to BSR members that a consensus for approval of a voluntary standard had not been reached. And there have been cases where in spite of several negative votes, those vitally affected by the standard were in favor of approval and the BSR approved the standard." [3]

It is quite evident from the above statement that there is a major weakness in the ANSI procedures that allow for unidentified manipulation.

I hope that my comments will give you and your associates information that will lead to your support to furnish adequate budget provision for Fiscal 1984 for the ICST to carry on their most important program.

Sincerely,

Norman J. Ream

Norman J. Ream

[1] President's Reorganization Project, Federal ADP Reorganization Project, Standards Study Team Final Report, June 12, 1978, pp. 7-8.

[2] Ibid., pp. 21-22.

[3] Opening Comments of Richard Lloyd, Acting Chairman, ANSI Board of Standards, Review Hearings, November 16, 1978, pp. 1-2.

MANUFACTURERS HANOVER TRUST COMPANY

4 NEW YORK PLAZA, NEW YORK, N.Y. 10015

March 21, 1983

The Hon. Doug Walgren
Chairman, Subcommittee on Science,
Research & Technology
2319 Rayburn House Office Building
Washington, DC 20515

Dear Mr. Chairman:

I would like to use the opportunity of this letter to submit comments to your subcommittee regarding the review of the proposed 1984 budget for the National Bureau of Standards. (Although I am an employee of Manufacturers Hanover Trust, these comments are my own and are not intended to represent the official views of the company). I am happy to hear that the subcommittee is taking a hard look at the budget before its approval. The budget, if accepted as proposed, calls for a drastic cut in funds for a branch of government which provides needed services to U.S. industry.

As a member of the American National Standards Institute (ANSI) working group currently developing a voluntary standard for Financial Message Cryptographic Key Management (ANSI X9.E9), I have worked closely with NBS's Institute for Computer Science and Technology (ICST). ICST staff members Dr. Dennis Branstad and Miles Smid have contributed significantly to our efforts to establish a standard which will make possible the secure exchange of financial service messages. Should budget cuts prevent their ability to participate with and assist us, their expertise would be sorely missed.

In addition to NBS's support of the voluntary standards development process, the Bureau also provides invaluable service to industry by the development of federal standards. Having worked on establishing voluntary standards, I can assure you that having a precedent-setting federal standard to serve as a guide is extremely helpful and may, in some cases, be essential. It is my belief that U.S. industry needs the standards and accreditation services performed by ICST. These services have done much to promote interoperability and assure technical credibility. I do not believe that industry will very easily be able to fill the void if NBS gets out of the business. Nor do I believe that reversing the process by modifying voluntary standards for federal use will result in federal standards of the same quality of those developed by NBS in the past.

It is my hope that the subcommittee will see fit to ensure that the funds are made available which are necessary for NBS to continue serving industry and government needs.

Sincerely,

Howard M Peace

Howard M. Peace

MAR 29 1983

SECURITY PACIFIC NATIONAL BANK
700 NORTH CENTRAL AVENUE, GLENDALE, CALIFORNIA 91203

March 25, 1983

Honorable Doug Walgren
Chairman of the Subcommittee on
Science Research and Technology

Dear Mr. Chairman,

This memo is in response to flyer #98-18 from the U. S. House of Representatives. The flyer discussed potential budget cuts for the National Bureau of Standards (NBS) in particular $7 million for the computer science and technology area. Based on my experience and exposure working on the ANSI X.9.9 working group it is my opinion that the function of the National Bureau of Standards can not be easily taken over by private industry. The contributions of the NBS representatives on the working group has been invaluable.

Barbara A Leider
Barbara A. Leider
Vice President
Security Pacific Nat'l Bank

DataGeneral
4400 Computer Drive, Westboro, MA 01580
Telephone (617) 366-8911

April 1, 1983

Dr. John D. Holmfeld
Science Consultant
Subcommittee on Science, Research,
and Technology
Committee on Science and Technology
2321 Rayburn H.O.B.,
Washington, D.C. 20515

Dear Dr. Holmfeld,

I am appalled by the Administration's proposal to drastically cut funding for the National Bureau of Standards' Institute for Computer Sciences and Technology. The importance of the Institute's role in the development and evaluation of Standards for the computer industry cannot be overestimated.

Since ICST is a commercially disinterested party, its contributions to the Standards-making process frequently serve as a technical reference point from which the biases inherent in positions taken by companies with competing interests may be measured. ICST is also in a position to drive the development of standards that benefit the industry (and its customers) as a whole, but lack the clear promise of commercial reward that is often necessary to generate enthusiastic private support.

I agree with the Administration that it is often desirable to shift the burden of funding for research and development onto the private sector that stands to gain from its results. In this case, however, neither ANSI nor the private companies that contribute to its work can effectively assume the role that ICST plays. Any curtailment of ICST's ability to participate actively in the standards-making process will have immediate and far-reaching negative effects on that process.

For these reasons, I urge you to recommend that funding for ICST's activities be increased, rather than reduced; at the very least, it should be maintained at the current level. I hope that such an outcome will follow naturally from a clearer understanding of the importance of the Institute's work.

Respectfully yours,

A. Lyman Chapin

A. Lyman Chapin
Distributed Systems Architecture
Data General Corporation

/ejc

The Honorable Don Fuqua
Page two
April 4, 1983

urge the Committee on Science and Technology to restore FY-1984 funding for the NBS Center for Fire Research at levels which will permit this valuable work to continue.

Very truly yours,

Ronald E VanGelderen

Ronald E. VanGelderen

REV:pup
cc: The Honorable Ed Jenkins
The Honorable Larry McDonald

GLENN ENGLISH, OKLA., CHAIRMAN

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DAN BURTON, IND.

(202) 225-3741

NINETY-EIGHTH CONGRESS
Congress of the United States
House of Representatives
GOVERNMENT INFORMATION, JUSTICE, AND AGRICULTURE
SUBCOMMITTEE
OF THE
COMMITTEE ON GOVERNMENT OPERATIONS
B-349-C RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, D.C. 20515

April 13, 1983

Honorable Don Fuqua
Chairman
Committee on Science and Technology
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

I am writing to urge you to continue funding for the Institute for Computer Sciences and Technology (ICST) of the National Bureau of Standards at current levels so that it can meet the demands placed on it under the Brooks Act and to continue its vital work in developing international information technology standards.

During the last Congress, as Chairman of the Subcommittee on Government Information, Justice, and Agriculture, I wrote to the Honorable Doug Walgren, Chairman of the Subcommittee on Science, Research and Technology, and expressed more specifically my concerns that the important work of the institute not be curtailed. Its efforts are vital in helping to preserve and promote United States trade in telecommunications and high technology goods and services. My sentiments have not changed. Therefore, I believe that continued funding at current levels is critical.

Sincerely,

Glenn English
Chairman

GLE/dca

W. Dale Compton
Vice President
Research

Ford Motor Company
P.O. Box 1603
Dearborn, Michigan 48121

April 13, 1983

The Honorable Doug Walgren
Chairman, Subcommittee on Science,
Research and Technology
U.S. House of Representatives
2321 Rayburn Office Building
Washington, D.C. 20515

Dear Mr. Chairman:

Ford Motor Company and other large manufacturing companies are increasingly using computer graphics and analysis to design and manufacture their products in order to increase productivity and compete effectively in the world markets. To effectively use the wide variety of computers needed in many different locations, both domestically and worldwide, techniques and standards for computer-to-computer communication are required. The development of these standards will also allow American computer manufacturers to better compete in the international markets by allowing them to be compatible while helping all American users of computers and computer communication systems to be more productive.

The Institute for Computer Science and Technology (ICST) of the National Bureau of Standards has been a very effective leader in this area. It has contributed to the development of the standards with a high level of expertise, successfully represented U.S. interest in negotiations with European standards organizations and provided outstandingly clear, usable interpretations of some of the resulting draft standards from the International Standards Organization (ISO). The ICST has provided very informed leadership and guidance to the Federal Government in this area as well as informing and assisting the private sector without interfering. They have provided a forum for mutual cooperation on standards that the companies could not provide themselves because of possible anti-trust implications.

We feel that the ICST is very important to America's productivity and its competitiveness with the rest of the world. We hope that funding for this effort can be continued within the constraints of the total budget.

Yours sincerely,

W. Dale Compton

APPENDIX VI

COST RECOVERY IN USER FEES

STATEMENTS AND LETTERS

simco electronics
382 MARTIN AVENUE • SANTA CLARA, CALIF. 95050
TELEPHONE (408) 727-3611

February 7, 1983

Mr. Doug Walgren, Chairman
House of Representatives Science, Research
  and Technology Subcommittee
2319 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Walgren:

The field of Measurement Science and dissemination of National Measurement Standards has been a prime responsibility of the National Bureau of Standards.

I wish to protest the recent decision to recover cost for NBS measurement related research from individual user participants in the calibration Measurement Assurance Programs known as MAP's. These programs, from my perspective, have done more to improve the accuracy level of the National Measurement System than any previous experimental efforts by the Bureau.

The National Measurement System is a web of users of measuring instruments affecting all facets of our daily lives. The measuring instruments used require efficient and state-of-the-art methods and standards to recertify their correct performance and accuracy. With the accelleration of technology, methods in many instances, have become more important to the system than the hardware standards. One of the important methods involves application of Quality Assurance concepts to measurement transfers from the best defined National Type I Standards to the Type II Commercial, Military, and Aerospace calibration laboratories.

These laboratories are not the ultimate recipient of the improved accuracies as they are simply service organizations trying to support the all pervasive web of measurements being made in the National Measurement System.

I am Vice President and Operations Manager of SIMCO, a calibration service company in Santa Clara, California. The company supports the measurements made by over twenty-five thousand instruments owned by our customers. This customer base includes Military and Civil Government Agencies and Laboratories; Manufacturers of Computers; Armament and Consumer Products. The measurement assurance concept has been used in many ways within SIMCO.

simco
electronics
382 MARTIN AVENUE • SANTA CLARA, CALIF. 95050
TELEPHONE (408) 727-3611

SIMCO has participated in a regional voltage MAP for 2 years with good success. In this very competitive small business venture, it would not be practical to consider paying $25,000, instead of the actual processing cost of $600, for the NBS service. In my opinion, many laboratories will reduce the level or frequency of service to avoid any sudden cost increase.

NBS management is also considering across the board cost increases for all calibration services as an alternative, which could increase calibration cost 3 to 5 times. As there is no real requirement through laboratory evaluation or accreditation regarding frequency of calibration, I suspect users will extend the interval between NBS calibrations to try and stay within budget. Again, the result would be to reduce the level of service and quality of calibration traceability.

I hold offices in several professional measurement organizations such as; President, Precision Measurement Association; Regional Coordinator, National Conference of Standards Laboratories; Director, Precision Measurement Society, and realize we are small groups with what seem to be narrow technical interest.

I wish to advise Congress that we represent a very pervasive, and not widely understood science of metrology. With very few exceptions, our ranks are filled with dedicated individuals seeking to do the nation a service by constantly improving the accuracy and reliability of measurements.

I am urging consideration of full budget support for the NBS MAP effort, rather than the cost recovery approach in this very important research effort. The budget, as I understand, lists $1.9 million as target for cost recovery. This is a small price to pay for a program development, which offers so much potential to raise the level of understanding by those who perform measurements and calibration.

The National Bureau of Standards has been one of the great national resources since it's founding, and should be supported by adequate funding of it's research programs. The Bureau's approximately $100 million budget has not kept pace with advancing technology, and, as a result, the Bureau is beginning to fall short in capacity to support the state-of-the-art manufacturing efforts which comprise the last real competitive edge the United States has in the international market.

SIMCO
electronics
382 MARTIN AVENUE • SANTA CLARA, CALIF. 95050
TELEPHONE (408) 727-3611

Please restore to the Bureau the priority required to insure U.S. Measurement leadership.

Respectfully submitted,

Carl Quinn

Carl Quinn
Vice President
SIMCO

Copy: John Holmfeld, Key Science Aide
2319 Rayburn House Office Building
Washington, D.C. 20515

Mr. George O. Rice, Chairman
NCSL Funding Study Ad Hoc Committee
Rockwell International
Mail Code HC02
3370 Miraloma Avenue
Anaheim, CA 92803

T.C. McDermott, Jr.
Vice President
Quality & Reliability Assurance

Rockwell International Corporation
Corporate Offices-El Segundo
2230 East Imperial Highway
El Segundo, California 90245

(213) 647-5008

Rockwell International

AR 9 1983

March 1, 1983

Honorable Doug Walgren
Chairman
Science, Research and Technology Subcommittee
U.S. House of Representatives
2319 Rayburn House Office Building
Washington, D.C. 20515

Dear Chairman Walgren:

Budget Request for the National Bureau of Standards

As you may recall, last year we wrote you concerning our interest in your Committee's deliberations of a proposal to revise the Organic Act of the National Bureau of Standards. We were most concerned that this national resource not be allowed to erode away - through well-meaning but shortsighted action. Our concern has been heightened by a newly adopted policy reflected in the Administration's FY 1984 Budget Request for the Bureau now being considered by your Committee.

As we understand it, this policy requires that beneficiaries of a service performed by the Bureau will be expected to pay fees which fully recover the costs incurred by the NBS in providing this service. On its face, this policy is consistent with the philosophy of this Administration and, we think, of most Americans. However, as being implemented at the NBS this policy will ultimately remove the NBS as the world leader in measurement research and technology development.

Since its inception the NBS has charged fees for the operational costs of providing its services to government, industry, academe, etc. Also since its inception the Congress has appropriated funds for the research and development carried out by NBS scientists, for the capital equipment necessary for a national standardizing laboratory, and for the costs associated with maintaining these national standards. However, in the budget proposal for FY 1984 it is noted that \$1.9M to fund R&D for measurement assurance programs has been deleted, together with some \$25M of other cuts. We have been advised that this deletion is being made because it is felt that the beneficiaries of measurement assurance programs should pay a fee which recovers the full costs - including the research and development. We think this implementation of an otherwise very sound policy is both wrong and shortsighted.

Research and development at the NBS - particularly research and development which concerns measurement standards and the dissemination of standards to industry, government, etc. - is a fundamental mission of the Bureau. As such it is a national investment in the U.S. measurement system infrastructure for today and into the future. It is properly a Congressionally-appropriated mission of the Bureau.

As being planned for implementation in October, users of selected NBS services (specifically Measurement Assurance Programs and Calibration Services) will be charged a fee which recovers not only the operational costs but also the costs of currently carried-out research and development. These current users are expected to pay for the costs of current research and development which can only benefit future users of the same or other services. Even amortizing current research and development costs over future fees has defects which make the implementation not only wrong but impractical.

It is requested that you and your Committee seriously consider this issue - not just the specific $1.9M line item which we believe should be restored - but also the underlying principle of how research and development by the NBS should be funded. It is our opinion that research and development carried out by the Bureau to further its mission as enunciated in the Organic Act is correctly and properly the province of government. It should be an appropriation by the Congress.

If I can be of further assistance to you and your Committee as you consider this issue please don't hesitate to call me.

Sincerely,

T.C. McDermott

T.C. McDermott
Vice President
Quality & Reliability Assurance

COUNCIL FOR OPTICAL RADIATION MEASUREMENTS
Committee Correspondence

March 14, 1983

Mr. John Holmfeld
Science and Technology Committee
U. S. House of Representatives
Washington, D.C. 20515

Dear Mr. Holmfeld:

We, the Council for Optical Radiation Measurements (CORM), an industry-NBS association, are quite concerned over the Administration's recent expressed intention to reduce the funding for measurement service programs.

CORM is composed of members of industry and academia who use and rely on the NBS to do research in, and then maintain, optical radiation standards. CORM with its broad measurement community base is able to propose measurement standards and technologies that are required, and can be justified, by the industry in order to improve productivity and efficiency of operation through reliable product performance standards.

The CORM membership, having heard of the Administration's proposed reduction especially in the Measurement Technology Transfer area, has reacted in alarm. All of the responses received from the CORM members who use the Measurement Assurance Program services expressed serious concern over their company's ability to continue in the MAP service and hence to retain any measurement consistency both nationally and internationally. An increase of fees would severely curtail the continuity of the standards maintenance since most companies would have to drop out of the service program. These factors would create costly problems within many industries.

All of the users of the Measurement Assurance Program service depend upon our national laboratory to advance the measurement certainty through improved techniques and reliable standards. The NBS is also looked to for the assurance of continuity in measurement, both nationally and internationally, so that industry can conduct its business using the "same language". To make the MAP service almost unavailable to most companies through a large increase in fees seems to us to be harmful to a large segment of our country's industry.

As an alternative to the fee increase, would it be possible to reduce the quality of the MAP service to one order of magnitude better than industry rather than the two orders now being developed and so reduce the charges of the MAP? Could an industry association under the guidance of the Bureau conduct the services which could provide the consensus, if not the accuracy, that the NBS offers?

The suggestion of alternatives and the extremely concerned nature of the responses to the proposed increase in the MAP fees are a clear sign that the users of the service are watching the outcome with alarm. What's at stake here is the ability of each company to have their measurements be consistent with a national reference. To withdraw from the MAP work, a reference service, as most companies will have to do when the fees are increased, will inevitably lead to measurement problems and reduced work efficiency.

We in the Council for Optical Radiation Measurements urge serious consideration of the effects an increase in MAP fees will have on industry's productivity, a consideration that should take into account the Bureau's charter to provide a national basis for measurements.

Sincerely,

E S Steeb

E. S. Steeb
President, CORM

address writer at:
General Electric Company
Lighting Business Group
Nela Park
Cleveland, OH 44112

ESS:kg

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March 14, 1983

Hon. Doug Walgren, Chairman
House Subcommittee on Science, Technology and Space
U. S. House of Representatives
117 Cannon House Office Building
Washington, D.C. 20515

Dear Mr. Chairman:

This letter is being sent to express our views concerning certain federal budget cuts proposed in the National Bureau of Standards (NBS) fiscal 1984 budget. We specifically take exception to the $700,000 cut in the National Voluntary Laboratory Accreditation Program (NVLAP) and the $3,170,000 cut in the Center for Building Technology (CBT).

Our main testing laboratory in Northwest Indiana and our Indiana Department of Highways laboratory, located in Indianapolis, utilize these voluntary programs to impartially keep their Laboratories credible.

Our Company is presently furnishing Concrete for a 90-10 Federal State project in Northwest Indiana and concrete strength is very critical. There are more projects of this type (where strength is critical) coming because it's the most economical system for the future.

If the NVLAP budget is cut, testing quality will suffer, resulting in project delays and investigative expenses which will far exceed the budget cuts.

Please reconsider restoring these funds to the 1984 budget for NVLAP and the CBT programs.

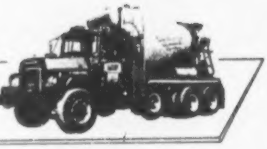
Yours truly,

CERTIFIED CONCRETE, INC.

Frances M. Gaither

Frances M. Gaither
President

FMG:lf



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March 14, 1983

Representative Doug Walgren, Chairman
House Subcommittee on Science, Technology & Space
U. S. House of Representatives
117 Cannon House Office Building
Washington, D. C. 20515

Dear Representative Walgren:

We wish to express our support for the National Voluntary Laboratory Accreditation Program (NVLAP) and the Cement and Concrete Reference Laboratory (CCRL). We feel that the cuts made in the fiscal year 1984 budget proposal should be restored.

Most appropriated funds are used for the development of new accreditation programs, support for laboratory accreditation programs in their first years before they become established, work in standards-writing bodies to advance the technology of accreditation and work with international standards organizations to advance the foreign trade and export relationships of the United States.

As you, yourself, have pointed out in announcing the upcoming hearings , "No evidence has been advanced to justify this expectation," referring to the idea that research activities would be taken up by the private sector. Therefore, we need to continue the appropriate federal funding.

NVLAP accreditation and proficiency testing programs will continue to provide a basis for recognition of competent laboratories. Laboratories need to monitor their own operations. Improper test results can prove very costly. Public safety is involved.

Inspection of testing laboratories is the most important activity of CCRL. It is important that a recognized authority provide the inspection and instruction needed to maintain quality control.

We feel a reexamination of the fiscal year 1984 cuts is vital.

Thank you for your consideration.

Sincerely,

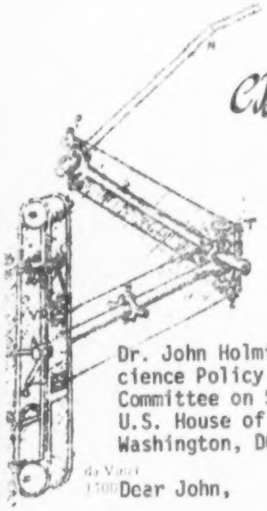
LA CROSSE CONCRETE COMPANY

Betty P. Heuslein
Vice President

APPENDIX VII

ROBOTICS R & D PROGRAM

STATEMENTS AND LETTERS



CIMAR CENTER FOR INTELLIGENT MACHINES AND ROBOTICS
D. TESAR, DIRECTOR 904/392-0814

23 February 1983

Dr. John Holmfeld
cience Policy Consultant
Committee on Science and Astronautics
U.S. House of Representatives
Washington, DC 20515

Dear John,

During our brief discussions I indicated my interest in a strong robotics effort and to specifically support NBS in this regard also. I submit herewith some supporting documentation (also forwarded to Congressman Fuqua and MacKay) to enhance your awareness of "why" we need to move forward now.

Sincerely,

Del Tesar

Del Tesar
Director, CIMAR and
Graduate Research Professor

DT/ld
encls.

P.S. Please find attached a letter to past Governor of Florida R. Askew responding to his request.

Beginning in 1945, the technology of robotics was derived from the urgent needs associated with handling nuclear materials. Since 1970, however, use of the robotic manipulator capable of duplicating complex human motor functions in industrial applications has made significant in-roads in the field of automation. Today, Japan has established itself as the leader with more than 45 percent of the world's robots. The United States, Northern Europe, especially France, and Russia are establishing robot industries in their countries, with varying degrees of government assistance.

THE ROBOTICS RACE IS ON

By Dr. Delbert Tesar

Internationally, robots are seen as a key to economic survival.

The relative importance of robotics to an industrialized country can best be illustrated in terms of the economic significance of mechanical automation in civil sector manufacturing. The U.S. robotics effort is the least cohesive in terms of a targeted national research and development, plan when considering all indicators. Manufactured goods represent 60 percent of total U.S. trade activity, with mechanicals (automobiles, office machines, cameras, et al.) representing 75 percent of that total. Yet only six percent of the nation's research and development money is spent to support this important portion of U.S. trade. Furthermore, only 0.7 percent of the U.S. government research and development in manufacturing goes to enhance technology associated with mechanical manufacturing. This has led to a weakening of U.S. trade capacity in manufactures (i.e., value added goods).

The imbalance between the amount of mechanicals sold by the U.S. and the amount of research and development money invested in the manufacturing process is at the core of the U.S. trade weakness in that field. This is most vividly demonstrated by the fact that the 20 worst deficit generators in the mechanical trades category created a $34 billion trade loss in 1978, equivalent to the U.S.'s trade loss in oil for that year. The figure is likely to approach $50 billion for 1982.

in 1978, equivalent to the U.S.'s trade loss in oil for that year. The figure is likely to approach $50 billion for 1982.

Dr. Delbert Tesar

Dr. Delbert Tesar is founder and director of the Center for Intelligent Machines and Robotics (CIMAR) at the University of Florida. During 1981, he toured 12 European research centers, including nine in Russia sponsored by the U.S.S.R. Academy of Sciences.

In 1978, Japan had a $63 billion surplus in manufactures and Germany had a $49 billion surplus, primarily in civil sector goods. These countries have strong national priorities to vigorously pursue vital technologies such as robotics for manufacturing. By contrast, Australia had a $10 billion trade deficit in manufactured goods (an equivalent, comparatively, of $200 billion for the U.S.), with negative trade ratios approaching ten to one in several categories. It is important to realize that 80 percent of the manufacturing in Australia is mechanical in nature. In most industrial countries, it is estimated that mechanicals represent 70 to 80 percent of manufactured goods. It is in the field of quality (precision) mechanical manufacturing capable of rapidly following a market (the customized product) for a competitive price (more for less) that robots can play a major role. Robotics — and the concept of the intelligent machine — is an emerging technology which can be used as a catalyst to strengthen civil sector manufacturing. Therefore, the field is of the highest importance to a nation's economic well-being.

During the past two years, the Russians have established robotics development and applications as a top national priority. Several scientific academies and institutes have established research teams comprised of 20 to 100 members each. The Paton Electric Welding Institue in Kiev is the largest. The Soviet Union's current five-year plan calls for the construction of 40,000 robots. Progress is occurring in Russia, since robotics manufacturing increased 88 percent in 1982 to a total of 3,600 units. The range of applications is very similar to those in the West. The Soviets have been major buyers of Western robots, including 50 Unimation robots and several French welding robots by Sciaky. The Soviets are known to have theoretical strengths in artificial intelligence (Leningrad), vision (Kiev), and structural kinematics (Moscow). Their primary weakness derives from their lack of proven component technologies, including compact microprocessors, encoders, servo-valves, precision hydraulic and electrical prime movers, and other robotic devices. Overall, the Russian technology is believed to be a decade behind that of the West.

Among the Communist bloc countries, Bulgaria represents a major center for robotics development outside of Russia. A factory for robotics is being established in East Germany and cooperative ventures among the Eastern bloc countries in robot welding cells are being pursued. An extensive effort to standardize robotic systems, software, and components is now being undertaken by principal decision makers in the COMECON countries. This effort includes a world-wide survey of the state-of-the-art which will result in the listing of technical requirements to meet projected needs over the next decade. On this foundation, component and system technologies will be delegated to group in the various countries for research and development and manufacture. The goal is to create a rapid, but orderly, expansion of robotics technologies in the Eastern bloc. The importance of this effort was highlighted by a trip by the late President Brezhnev to East Germany, in 1981, to organize that country's portion of this cooperative venture.

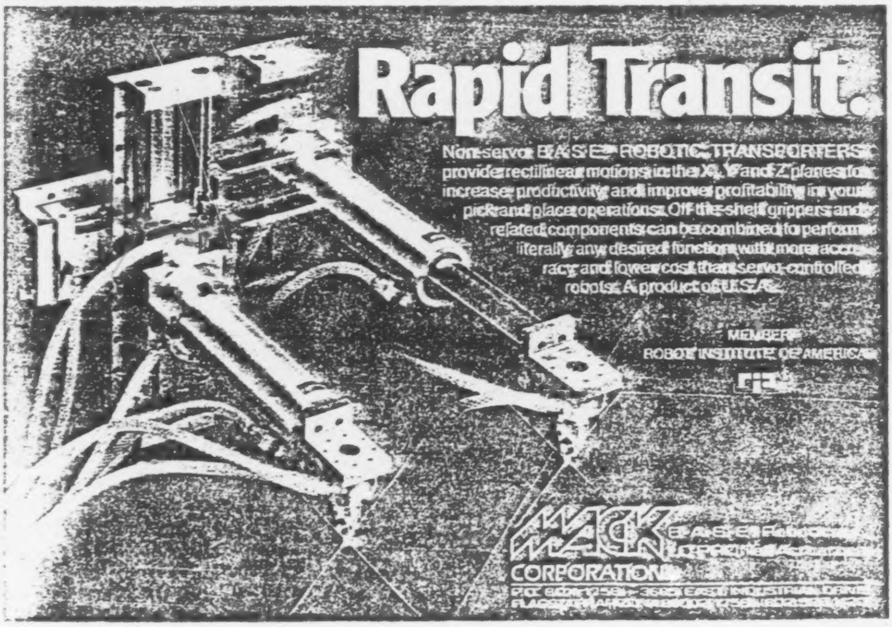
The French government recently has added robotics as a new element to its national strategy for enhanced technological vitality. Its minister for research and industry has proposed to spend $360 million over the next three years for robotics. This program includes $36 million for equipment at research laboratories; $325 million for research grants to develop advanced robots; and four to five geographically distributed robotics research centers. The minister states that the goal is to boost French productivity by seven percent annually during the next decade. This is twice the increase expected in the United States.

As we look ahead to the next generation of robot systems, we see not the type of human imitations made famous by Hollywood, but machines capable of precise measurements and movements. The human system performs its functions because of unsurpassed hand-eye coordination. Nonetheless, the human system is probably a very poor model on which to base the design of a machine which will perform precise mechanical operations under load. This fact has not been widely recognized and, to a great extent, slows the scientific community's response to this valid need. No human hand is capable of precision measurement or is capable of precision machining operations under load. Therefore, the human model for robotic manipulators is adequate for the simple repetitive tasks now being pursued in industry such as pick-and-place, spot welding, spray painting, surveillance, and unloaded assembly. A precision system capable of high loads in real-time operation could perform precision machining without jigs, precision inspection during operation, multi-level operations under CAD CAM control, and force fit assembly.

Most manipulator arms are accurate to about 0.050 inch, which is insufficient for many precision operations such as assembly operations and spatial motion functions such as laser cutting and welding operations. Precision requirements will intensify as robotic systems become smaller and are applied to such functions as microsurgery. Generally, deformations under small applied loads in existing commercial systems substantially exceed the static (or repetitive) precision level they can achieve. In addition, the operating environment — temperature, loads, shocks and vibrations — cannot always be considered invariant. Hence, future robotic systems must be much more adaptable to "control-in-the-small," and real-time modeling to meet this second higher level of precision must be developed in the next generation of robots.

Effective development of robotics technology demands integration of disciplines that are frequently considered separate. The primary marriage is of mechanical and electrical engineering, although many other technologies are involved as well. There appears to be insufficient effort towards combining man with machine to enable the uniform penetration of this emerging technology into the workplace. The best opportunity in the immediate future is to balance human and machine capabilities for many applications. As the machine technology improves, less will be asked of the human and more of the machine. This man-machine approach allows the most rapid penetration of the manufacturing market with the near-term technology, allows a gradual and natural transference to more machine-oriented systems, and allows a minimum disruption of the manufacturing workforce.

The time of the intelligent robot is upon us. Virtually every industrialized society has significant research and development in robotics activity as well as a first generation of applications. As the number of applications increase, the demands on the technology will result in carefully integrated systems increasingly made up of modules and scaled more effectively to the task. Miniature robots will be essential for micro-surgery and the assembly and repair of micro-circuits. No longer will "add-on" technologies suffice — the present disciplines of mechanical and electrical engineering will tend to merge into what the Japanese call "mechatronics." Society, in general, will accept the image of manufacturing as a high technology field and reap the benefits of less-expensive, yet higher-quality goods.



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ROBOTICS:

An Economic Issue

Dr. Delbert Tesar
Director, Center for Intelligent Machines and Robotics
University of Florida

Industrial robots are now a reality, and they are having an impact in the field of automation. But what is their potential economic benefit? What are some of their future applications? What are some of the limitations of the existing technology, and is our present R&D effort sufficient and on target? These questions are addressed in this brief listing of issues facing those involved in the development of robots.

Over the past several years, I have analyzed the conditions affecting manufacturing in the United States, documented our relative competitiveness — not only internationally, but especially in our home markets — and pointed to some basic factors associated with our weakening trade capacity.

Manufactured goods represent 60% of total U.S. trade activity, and mechanicals (automobiles, office machines, cameras, etc.) represent 75% of that total. Yet only 6% of the nation's research and development money is spent to support this important portion of U.S. trade. Furthermore, only 0.7% of our federal R&D in manufacturing goes to enhance technology associated with mechanical manufacturing. That has led to a weakening of our trade capacity in manufactures (i.e., value added goods).

The imbalance between the amount of mechanicals sold by this country and the amount of R&D money invested in the manufacturing process is at the core of our trade weakness in that field. This is most vividly demonstrated by the fact that the 20 worst deficit generators in the mechanical trades category created a $34 billion trade loss in 1978, equivalent to this country's loss in oil for that year. The figure is likely to approach $50 billion for 1982.

Historically, American products were considered to be of good quality. During the 1950's, U.S. machine tools were considered the best in the world. Now, not only is Japanese equipment competitive in quality, but also in price — evidenced by the fact that they now produce 45% of the world's robots. Robotics — the concept of the intelligent machine — is an emerging technology which can be used as a catalyst to offset our present lack of competitiveness in civil sector manufacturing. Enhanced manufacturing productivity and reduced hazards to operational personnel performing dangerous tasks are two primary pressures which govern present and future applications for robotics.

It's important to realize that 25,000,000 people are now employed in manufacturing in U.S. industries, of which more than 10,000,000 are performing manual functions on a semi-repetitive basis. Today, it is estimated that 5,000 robots are operating in the U.S. This represents a penetration of not more than 5 in 10,000. Other countries are outstepping the United States. For instance, increasingly Japanese plant development is moving towards the manless factory or the factory without lights. Similar advanced factory development is taking place in northern Europe.

At the same time, the United States' annual robot research and development budget, some $16.5 million, is smaller and much less cohesive than that of Japan and France. Advanced factory development similar to that of Japan is taking place in northern Europe. The technology of intelligent, flexible machines as represented by robots is perhaps the central technology involved in these efforts. It's apparent that expanding our activity in the field of Flexible Manufacturing Systems (FMS) will require a major cohesive effort by all parties in the entire U.S. technological community.

Ocean floor activity illustrates the usefulness of robots to perform hazardous tasks. With 19% of the world's crude oil coming from offshore sources, the ocean floor has great economic potential if a means of tapping that potential can be found. Costs for offshore drilling efforts are high. The Mobil Oil Condeep drilling platform cost $1.3 billion to handle 42 wells, some as deep as 9,300 feet, and operates in 500 feet of water. Future systems planned by Exxon will be submerged and operated at a depth of 5,000 feet. Remotely Controlled Vehicles (RCV) become economical at these depths. For example, at 1,000 feet, a diver may work for 10 minutes at a total cost of $100,000, while a remotely controlled craft costs $3,500 per day. Today's RCV's are relatively simple, but they can inspect structures, pipelines and cables; place and recover instruments; set explosives; clear fouled lines; and survey under ice.

As we look ahead to the next generation of robot systems, we see not the type of "human imitations" made famous by Hollywood, but machines capable of precise measurements and movements. The human system performs its functions because of unsurpassed hand-eye coordination. Nonetheless, the human system is probably a very poor model on which to base the design of a machine which will perform precise mechanical operations under load. This fact has not been widely recognized, and to a great extent slows the scientific community's response to this valid need. No human hand is capable of precision measurement or is capable of precision machining operations under load. Therefore, the human model for robotic manipulators is adequate for the simple repetitive tasks now being pursued in industry such as pick-and-place, spot welding, spray painting, surveillance, and unloaded assembly. A precision system capable of high loads in real-time operation could perform the following tasks: precision machining without jigs; precision inspection during operation; multi-level operations under CAD/CAM control; and force fit assembly.

Most manipulator arms are accurate to about 0.050 inch which is insufficient for many precision operations such as assembly operations and spatial motion functions — for example, laser cutting and welding operations. Precision requirements will intensify as robotic systems become smaller (microrobotics) and are applied to such functions as microsurgery. Generally, deformations under small applied loads in existing commercial systems substantially exceed the static (or repetitive) precision level they can achieve. In addition, the operating environment — temperature, loads, shocks, vibrations — cannot always be considered invariant. Hence, future robotic systems must be much more adaptable to "control-in-the-small," and the real-time modeling to meet this second higher level of precision must be developed in the next generation of robots.

Examination of robotic technology shows certain important facts. The industrial robot arm may cost up to $100,000. In contrast, the specially designed space shuttle manipulator development and deployment cost was $100 million. It's evident that unusual technology in this field is extraordinarily expensive.

Effective development of this technology demands integration of disciplines that are frequently considered separate. The primary marriage is of mechanical and electrical engineering, although many other technologies are also involved. There appears to be insufficient effort towards combining man with machine to enable the uniform penetration of this emerging technology into the workplace. The best near-term opportunity is to use a balance of human and machine capabilities in many applications. As the machine technology improves, less will be asked of the human, and more of the machine. This man-machine approach allows the most rapid penetration of the manufacturing market with the near-term technology, allows a gradual and natural transference to more machine-oriented systems, and allows a minimum disruption of the manufacturing workforce.

I conclude that: robots are an important part of the future for manufacturing and that future robots will perform functions beyond today's concepts of the machine; robots will augment human capabilities (not only displace the operator and thus de-skill our workforce); robots cannot be oversold to the young student or researcher, but present robot technology can be oversold to decision-makers in industry; and that our present R&D level in the field is not only insufficient, off-target and incohesive, but that other nations are accelerating their development to our future disadvantage.

Delbert Tesar is the founder and director of the Center for Intelligent Machines and Robots (CIMAR) at the University of Florida. The interdisciplinary center created in conjunction with a developing robotics laboratory that includes four robots, a dedicated Harris super-minicomputer system and 15 peripherals, has 10 faculty members and approximately 25 students. Tesar was elected to the Robotics International of SME board of directors in 1982 and also received the ASME machine design award that year. In 1980 he served on an Air Force review committee for the MANTECH program, and was appointed to the Air Force Science Advisory Board in 1982. Tesar earned both his bachelor's and master's degrees at the University of Nebraska, and his Ph.D. from the Georgia Institute of Technology under a Ford Foundation Fellowship. He has been at the University of Florida's Department of Mechanical Engineering since 1965. He has done machine system research for 20 years, and developed undergraduate and graduate courses which emphasize the creation and analysis of mechanical devices, including the robotic manipulator. The author of numerous publications, Tesar has been a consultant to major U.S. corporations and has travelled and lectured extensively in Europe.

CIMAR CENTER FOR INTELLIGENT MACHINES AND ROBOTICS
D. TESAR, DIRECTOR 904/392-0814

January 19, 1983

The Honorable
Reubin O'D. Askew
1465 South Miami Avenue
Miami, FL 33131

Dear Governor Askew:

I am pleased that you, as a Floridian, have committed yourself to run for the Presidency. I would be pleased to be of assistance to you in an advisory capacity and look forward to a personal exchange of views that might prove useful to you and your staff during the campaign. I have asked permission of my dean of engineering to work with you in this capacity. His office feels that this is a valid and appropriate role for me to assume so long as my position at the University is not diminished or misused and so long as my role does not take on an explicit public political stance. The issues that I will raise are not in their own right political but the means to achieve the desired outcome are. Over the years, I have worked closely with Congressman Don Fuqua. We have kept this interaction as quiet and invisible as possible. Yet, the benefit has been great. I hope it can be as helpful in this case, also. I know that we hold many common views as derived from the three speeches you forwarded to me in your January 4, 1983 letter.

First, I believe it is important to note that my bias is engineering education, and more particularly that associated with manufacturing which generates approximately 2/3 of our real wealth in the U.S.A. In order to achieve acceptance of theoretical and applied research in this discipline, I have found it necessary to isolate key factual material and state conclusions which warrant continued or enhanced interest by policy makers and funding agencies.

As a consequence, I wish to summarize my present understanding by means of the following items:

1. The economic reality is that wealth generation is 1/3 of the GNP of the U.S.A. of which 2/3 is due to manufacturing. Of this 2/3, 60% or more is mechanical in nature, primarily in the civil sector. Yet, industry invests less than 6% of its R&D and its manpower to meet this need. The federal government invests less than 0.7%.

2. These major imbalances continue to weaken our civil sector and allow penetration into our home markets by other strong civil sectors; i.e., Japan, Germany, and in the future France. These three countries are building their civil sectors by various policies as a top national priority.

3. The U.S. emphasis on defense material consumes our limited science and engineering manpower. For example, 86% of the U.S. federal R&D for manufacturing (about 50% of the total federal R&D) goes to two fields, electronics and aircraft (missiles). Even though one may argue for or against this emphasis, it exists as a reality in our economic system.

4. Frequently, it is argued that spin-off of the defense R&D will occur to the civil sector. I wish to assert that spin-off is only possible if a vital and aggressive technical manpower base exists in the civil sector. Since only 6% exists in our civil sector, then other societies which have strong civil sector manpower pools may be the primary beneficiaries of this spin-off.

5. Unfortunately, the Reagan administration has not taken steps to counter this dilemma. The 1981 tax bill made the growth of physical plant capital more likely--a procedure proven to be effective in the '50s. The administration has not simultaneously taken steps to enhance our human capital appropriate for knowledge based industries. This reduces the resources available to the universities from all sources including industry and the federal government. Hence, as industrial needs shift more and more to technological manpower, the federal government must also shift its policy in proportion to this reality.

6. The U.S. government has established a sense of urgency (the problem has been identified). It has not yet established a sense of purpose (strategy for both capital and knowledge based industries) nor has it established a sense of magnitude (put the game players together in proportion to their potential contribution or need).

7. One vital part of the solution is to bring industry and academia together on a negotiated set of objectives for mutual benefit. Apparently, the U.S. government is unwilling--hence, the competition among states may prove a new vehicle (if exploited) to perform a major portion of the human capital enhancement. I.e., leave the physical plant enhancement to the federal government and the human resource enhancement to the states.

8. One caveat requires, however, that the universities continue to identify themselves primarily with manpower generation. Too great a movement towards autonomous laboratory functions (i.e., the Georgia Tech Experiment Station) unnecessarily competes with other mission sectors supported by the community such as government labs, consulting firms, industrial labs, etc.

9. It may seem to be appropriate to ask industry to play a larger role in developing manpower. However, during the past two decades, industry has provided no more than 3% of the funds for university research and manpower generation. This is not expected to change significantly since no new incentives have been established.

Consequently, I recommend that more concern be placed in strengthening NSF in the field of manufacturing technologies and to ensure that DOD augment its role in the universities to generate an increased number of young scientists and engineers. Note that by contrast to our 5% engineering graduates relative to all graduates in the U.S., Japan has 15%, Central Europe has 20%, and the Eastern Block has 40%.

10. Australia represents a developed country having a scale 1/20th that of the U.S. It has attempted to control its destiny by controlling its outputs (mineral resources in the world market and tariffs to protect its home markets). This approach is beginning to fail. Fifteen years ago, Japan agreed to purchase minerals and coal from Australia if they were allowed to enter Australia's home markets with manufactured goods. Now Japan has the portion of the Australian home markets they need and are now shifting their purchase of minerals to other countries such as Argentina and Venezuela. This is a direct form of external manipulation due to weakened Australian manufacturing technology caused by over-protection from high tariffs. It may be too late for Australia but the U.S. can learn a great deal from this experience.

11. During the last decade the U.S. has lost 30-50% of its take home pay per worker relative to other developed societies such as Japan and Northern Europe. In fact, some suggest that the take home pay of Northern Europe is 20% above that of the U.S. (a numerical issue that should be very carefully verified). If our relative take home pay has deteriorated so badly, why? Since our markets are open to all competition (some of it unfair) our only protection is to run faster than our competition. To do so means that we must have a national policy. I contend that we have always rejected this need and the penalty is now becoming apparent.

12. One of the largest and most punishing penalties beyond loss of take home pay (standard of living) is loss of jobs. We have lost 250,000-300,000 jobs in the auto industry. We make few of our own sewing machines, 30% of our shoes, 50% of our clothes, etc. If you accumulate 20 of these worst generators of trade deficit, in 1978 the loss was $34 billion equivalent to our loss in oil. Today, I estimate that this loss is approaching $50 billion with an associated loss of 1,000,000 or more jobs. This is partially the result of a non-competitive technology and supporting human capital. Hence, we are beginning to run slower than our competition. Some will want to raise tariffs. I say that for our

country, that is the ultimate danger as adequately demonstrated by Australia and long since known to us in the example of the U.K.

13. These downward pressures are particularly difficult on our heterogenous society. Downward pressure means more social disruption (the opposite of rising expectations). Hence, strong civil sector technology may prove more important to our security than offensive weapons as developed under our DOD program.

14. Many say that high technology is the answer. It is if properly interpreted. If the product is of quality, if it rapidly follows a changing market, and if it meets a competitive price; then it is high technology. This can be shoes made with robots or it can be microchips made in a clean room, etc. This view eliminates the argument that we should let dying industries die (a comment I have heard from Lockheed Management). Such statements mean that we accept technological defeat which then leads to fewer jobs and less take home pay.

15. We have put far too much emphasis on energy in the U.S. Note the following data in 1978:

	Energy Self-Sufficiency	Surplus of Manufactured Goods
U.S.	75%	- $10 Billion
Japan	10%	+ $63 Billion
Germany	40%	+ $49 Billion
Australia	140%	- $10 Billion

If energy were pervasive in wealth generation then these numbers would be compatible—but they aren't. Hence, civil sector technology is the key as the Japanese have long recognized (as should also Florida).

16. The question fundamentally comes down to national policy. Do we control our inputs or our outputs. Japan controls their inputs first (R&D, manpower, etc.) while Australia controls its outputs (tariffs, minerals, etc.). If you attempt to control your outputs, you lose your greatest asset, human capital for value added. If you wish to control the inputs, you increase these resources but your planning must be much more long term and you must remain committed. We are increasingly less committed and don't always recognize the inputs that need to be adjusted.

17. Finally, the inputs and outputs must be in balance. Hence, if too much human capital and R&D pursues too small a market, you leave your flanks open--a situation happening in our civil sector. For example 86% of Federal R&D for manufacturing goes to Electronics and Aircraft. This leaves 14% for everything else. About 75% of our market is mechanical manufacturing but only 6% of our Nation's R&D (both industrial and Federal) supports it (a 10 to 1 imbalance) and 0.7% of our Federal R&D for manufacturing supports it (a 100 to 1 imbalance). Similar arguments hold for similar imbalances in committed scientific manpower. Hence, I say that our policy is very distorted and definitely biased against the wealth generating (take home pay and jobs) civil sector.

18. We should put most (60%) of our Federal R&D into payoff in the next ten years, 30% for payoff in the second decade and 10% in the third decade. Unfortunately, contrary to Japan's view of this time line, we put too much emphasis on payoff in the 2nd and 3rd decades as demonstrated by our wealth in Nobel prizes but not our wealth in trade and human capital for value added manufacturing.

Governor Askew, these items are derived from numerous position papers I have written over the past 5 years. I am packaging this reference material for you in four groups:

1. Articles on the specific technologies associated with robotics:
    a. Two page abstract on robotics and its future impact
    b. A recent Business Week article on robotics in Japan
    c. A recent Business Week article on robotics in Russia
    d. A one page summary of my trip to Russia reviewing their research in robotics.
    e. A four page Machine Design article summarizing my trip to Russia.
    f. Testimony on robotics submitted to Congress on June 6, 1982. This testimony summarizes my overall view of the economic and technical status of robotics technology.
2. Position Papers dealing with the economics of manufacturing and suggestions for a partial national strategy:
    a. A 3 page summary of my position on economic and technical issues associated with manufacturing.
    b. Science paper: Mission Oriented Research in Light Machinery.
    c. Two lead articles on Mechanical Manufacturing (output) and R&D (input) in the Mechanical Engineering Journal.

   d. Testimony to Congress on engineering manpower with emphasis on balance and international competition.

   e. A 30-page summary of my trip on robotics in the Academy of Sciences in Russia.

3. An extensive report on manufacturing issues in Australia written by analogy with the condition in the U.S. Several warning signals for the U.S. are mentioned in terms of the possible external manipulation of Australia.

4. Specific items describing the research program at the University of Florida:

   a. Listing of our proposed research
   b. Center project bulletin
   c. Spectrum of center research topics
   d. One page status of the center
   e. One page resume of D. Tesar

As you and your staff review this material, please feel free to call on me at any time (904-392-0814). I look forward to a useful interaction and a conversation in the very short term.

Sincerely,

Del Tesar

Del Tesar
Graduate Research Professor and
Director of the Center for
Intelligent Machines & Robotics

DT/ld
encls.

APPENDIX VIII

RECYCLED OIL STANDARDS

STATEMENTS AND LETTERS

APR Association of Petroleum Re-refiners

2025 Pennsylvania Avenue, N.W.
Suite 1111
Washington, D.C. 20006
Telex: 904059 (WSH)
Telephone: 202-833-2694

February 9, 1983

Honorable Doug Walgren
Chairman, Subcommittee on Science,
Research and Technology
U. S. House of Representatives
2319 Rayburn House Office Building
Washington, D.C. 20515

Dear Chairman Walgren:

In a short time your committee is scheduled to consider the budget for the National Bureau of Standards for Fiscal Year 1984. I understand that the NBS budget for FY 84 is sharply reduced from the budget of FY 83, and that there are no funds in the 1984 budget for completion of the NBS research on recycled oil.

We are writing to express our concern on this issue and ask that your committee include funding for FY 1984. NBS is in the final phase of its research on recycled oil, and less funding would be required for FY 84 than in previous years. Earlier funding for this program was about 1.25 million dollars per annum, which was reduced to one million dollars for FY 83. We suggest that the program could be concluded in FY 84 for eight hundred thousand dollars.

The recovery and reuse of used oil is beneficial to the environment, the conservation of our own natural resources and is a small but important step in the goal of energy independence. With this in mind, Congress passed Public Law 96-463, The Used Oil Recycling Act, in 1980. This legislation aided the growth of the re-refining industry in the United States and is proving effective in the increased recovery and reuse of more than 1.5 **BILLION** gallons of used oil that this country generates annually.

One important and necessary factor to the complete recovery and reuse of used oil is the availability of simple and inexpensive tests to determine the quality and equivalence of recycled oils. The National Bureau of Standards has been conducting valuable research in this area since 1976. The first phase of this research, which related to used oil utilized as a fuel, is complete and the report was published in 1978.

Since that time, the Bureau has been working on Phase II of the program which relates to lubricating oils. This is the most important aspect of the entire program. Completion of this research, including base stock consistency, equivalency and verification studies, is of vital importance to the oil recovery industry and the lubricating oil consuming public as well.

The NBS has completed almost all of its research to develop test procedures for determining consistency and equivalency. They are now in the final phase of arranging for engine sequence testing to determine if the procedures developed in the earlier phases of the research are valid. Without the verification of the engine sequence tests, previous research would have very limited value, if any.

It is our understanding that the NBS has contracted for the engine sequence tests which are scheduled to begin in June 1983. These tests will not be completed until December 1983, well into the FY 84 budget year. At the completion of the tests, NBS must review them, evaluate their impact, and issue their final report. At that time the NBS research will be complete, with no need for further funding in FY 1985.

The recycled oil program is unique from many other research programs in that without the completion of the verification studies now underway, past research and developed tests will not be proven and past funding will be wasted. There are no intermediate results in the recycled oil program that provide usable benefits or final results that may be applied by industry.

For this reason we are asking that your committee fund the NBS recycled oil program in the amount of $800,000 for FY 1984.

Thank you for your consideration of this request. If we can be of any assistance or answer any questions, please do not hesitate to contact us.

Very truly yours,

James A McBain

James A. McBain
Executive Director